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2004 RECLAIM Amendments: Final Report

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1. Introduction

The South Coast Air Quality Management District (SCAQMD) started the Regional Clean Air Incentives Market or RECLAIM on January 1, 1994. This market is the oldest of the local emission-trading markets in the United States. Below is a discussion of the main points of the RECLAIM market, including the market design, monitoring and reporting requirements, price history, market performance, and common transaction structures. Relevant to this analysis, SCAQMD's RECLAIM program controls the amount of nitrogen oxide (NOx) released in a 1-credit-to-1-pound-NOx-emitted ratio. The RECLAIM authorities issue RECLAIM Trading Credits or RTCs at a zero-cost basis to all sources whose yearly emissions are greater than 4 tons (8000 pounds) per year. Geographically, RECLAIM covers all of Los Angeles, Orange, and San Bernardino counties, along with half of Riverside County.

Since RECLAIM began in 1994, actual emissions from all sources in the program have been reduced by more than 50%. NOx credit prices have fluctuated somewhat, but they have remained fairly stable and affordable with one notable exception. During the California energy crisis in 2000 and 2001, the rapid increase in demand for NOx RTCs by power producers contributed to a spike in NOx RTC prices. As a remedy, the SCAQMD temporarily restricted trading by the power producers. Unused NOx RTCs in the market have also fluctuated, but average around 20% of the total supply with the exception of 1999 through 2001.

RECLAIM facilities are divided into two cycles and two zones. The first cycle occurs on a calendar-year basis, while the second cycle occurs on a fiscal year (July 1-June 30) basis. The two zones result from the local geography. Los Angeles (LA) is located in a basin with a mountain range directly east of it. The industrial area is located close to the coast. LA's traditional status of dirtiest air in the nation is partly a result of this geography. In the morning, the wind blows in from the Pacific Ocean and picks up the air pollutants. By mid-day, the airflow has stagnated because the mountain range that forms the eastern boundary of the LA basin has blocked the air. In the evening, the airflow reverses directions and heads back out to sea, taking the air pollutants along. The next day, the whole cycle starts again. Accordingly, RECLAIM is split into two zones. Zone 1 is the coastal zone. Zone 2 is the inland zone.

The RECLAIM program replaced several existing command-and-control rules and Air Quality Control Plan (AQCP) control measures. The State requires RECLAIM to be as effective as the rules it replaced and be equivalent to Best Retrofit Control Technology (BARCT). The SCAQMD is currently analyzing the equivalency requirement and has determined that the amount of NOx RTCs in the program should be reduced.

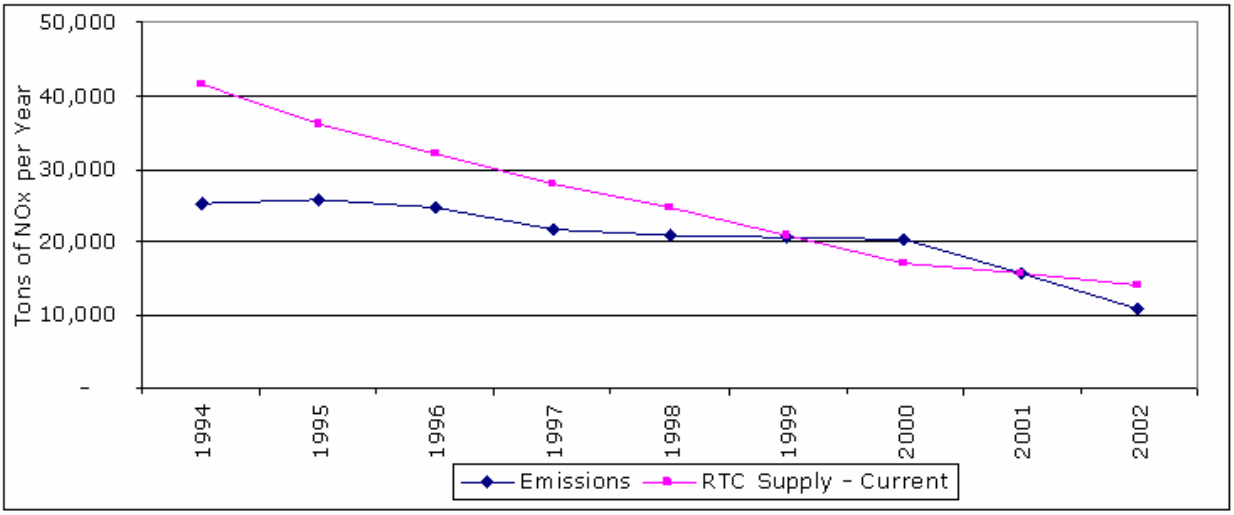
Our purpose in this report is to analyze the market implications of reducing the total NOx RTCs in the program by 2, 3, or 5 tons per day, as well as the Phase I & II plans, which calls for a two-step total reduction of 21.6% NOx reduction by the year 2010 or 2013, taking into consideration the amount of unused credits in the

market, the future installation of control equipment, and the regional economic-growth assumptions.[1]

2. Base Scenario—Historical RTC Market Transactions

Figure 2.A. shows the current RTC supply and demand, as represented by NOx emissions. Historically, with the exception of the 2000-2001 period, there has been an excess of RTCs in the RECLAIM market, with the excess ranging from 37 percent in 1994 to 15 percent in 1998, and back up to 22 percent in 2002. However, during the California energy crisis, the RTC market was near equilibrium in years 1999 and 2001, and it faced a shortfall of 19 percent in 2000.

Figure 2.A.: Current RTC Supply and Demand, 1994-2013 (tons of NOx)



Source: RECLAIM Audit Report (http://www.aqmd.gov/hb/040435a.html)

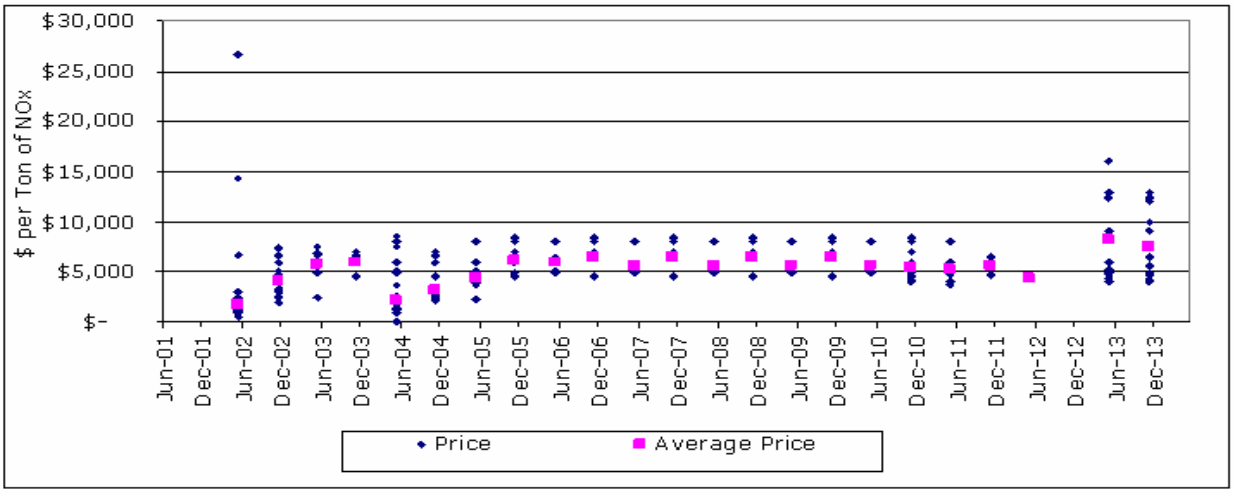
Because of this excess RTC supply, since 1994 the price of RTCs has been lower than anticipated by the SCAQMD, again with the exception of years 2000 and 2001. In the following, we show only the monetary transactions involving brokerage firms, which are approximately half of all transactions. The non-monetary transactions involving RTC trading among RECLAIM participants are equally important as the monetary transactions; however, we could not find a way to estimate the total value or amount of NOx that are transacted in these non-monetary trades.

Figure 2.B. shows the actual and average price of RTC transactions for RTCs that expired or will expire from June 2002 to December 2013. The transactions revolve around Cycle 1 (December) RTCs, and Cycle 2 (June) RTCs. It is important to point that the transactions in Figures 2.B. and 2.C. represent a snapshot of all the RECLAIM transactions that were recorded as of July 15, 2004. As such, the figures are not meant to, nor do they paint a complete picture of the RECLAIM market. Regardless, there is substantial amount of historical data to reach the following conclusions. First, price ranges for both the individual transactions and the average price of RTCs are fairly extensive, with the average price ranging from over $1,700 per ton of NOx for June 2002 RTCs to over $8,000 for June 2013 RTCs. However,

[1] All the data in this report are from South Coast Air Quality Management District (SCAQMD) and are available online at www.aqmd.gov.

despite this wide range for RTC prices, they are still far below the $15,000 per ton that would trigger a program evaluation by SCAQMD. Furthermore, as we stated earlier, over half of RTC transactions are non-monetary, implying that it is very difficult for us to estimate either the actual market-clearing price for RTCs or the participants' willingness-to-pay for the credits.

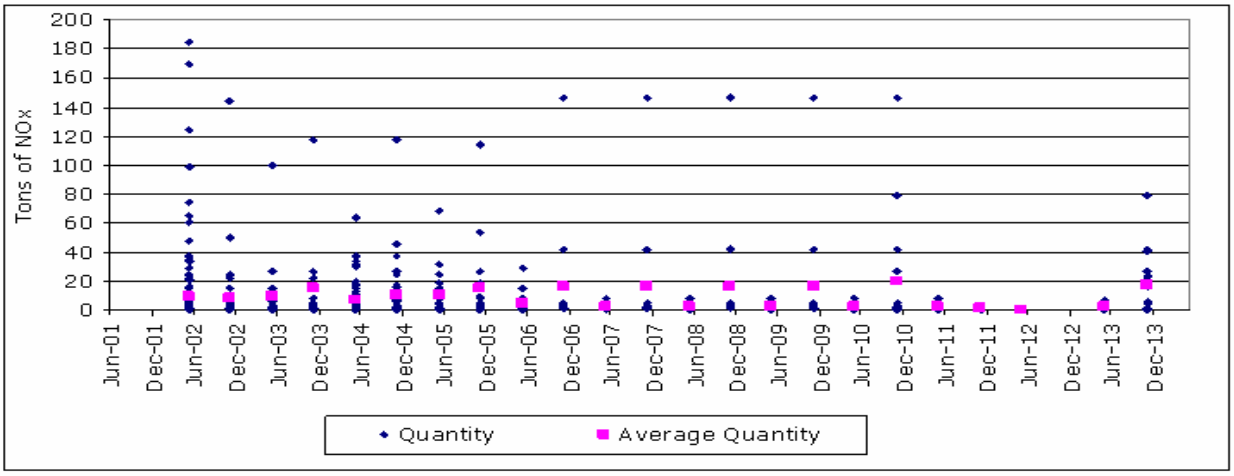
Figure 2.B.: Actual and Average Price for Monetary RTC Transactions, June 2001 to December 2013 (Dollars per Ton of NOx)



Source: SCAQMD RTC Trade Information (http://www.aqmd.gov/reclaim/rtc_main.html)

Finally, Figure 2.C. shows the quantities of RTCs transacted or that are projected to be transacted from June 2001 to December 2013. Given the overall size of the RTC market, an overwhelming majority of the actual transactions are fewer than 20 tons of NOx, with only about 20 percent exceeding 100 tons of NOx. These transactions include both monetary and non-monetary transactions, suggesting that for the majority of the participants in the RECLAIM market, open-market RTCs represent contingency credits that augment their allocated RTCs.

Figure 2.C.: Actual and Average Quantities of Transacted RTCs, Monetary and Non-Monetary, June 2001 to December 2013 (Tons of NOx)



Source: SCAQMD RTC Trade Information (http://www.aqmd.gov/reclaim/rtc_main.html)

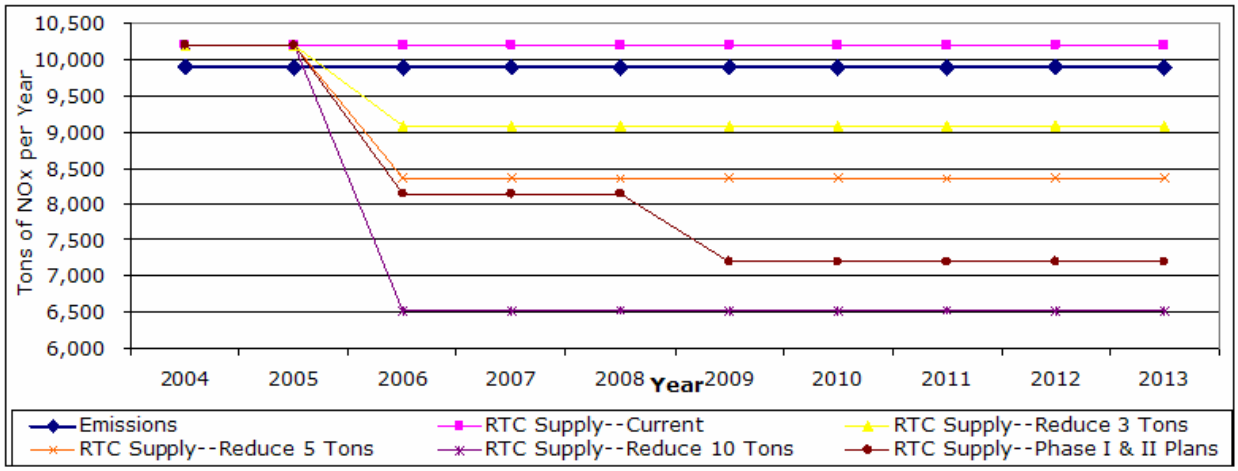
The fact that RTCs are used mainly as a contingency has significant implications for forecasting future demand scenarios, because it suggests that the majority of participants usually find internal solutions in the plant as means to reduce the number of RTCs (Figure 2.A.). We therefore assume that participants will continue to look for internal answers to their emissions and will use the RTC market mainly as an auxiliary solution to meet emission levels.

3. RTC-Reduction Scenarios without Control Measures

As we noted earlier, the State requires RECLAIM to be as effective as the rules it replaced and be equivalent in terms of NOx emissions to Best Retrofit Control Technology (BARCT). Currently, the SCAQMD is analyzing the equivalency requirement and has determined that the amount of NOx RTCs in the program should be reduced. Figure 3.A. shows the supply and demand scenarios for different levels of tonnage reduction. In all of the following scenarios, the years 2004 and 2005 are base years, and all the analyses refer to years 2006-2013.

Scenario 1: Current RTC supply levels (Current)
Scenario 2: 3-tons-per-day reduction in NOx emissions (Reduce 3 Tons)
Scenario 3: 5-tons-per-day reduction in NOx emissions (Reduce 5 Tons)
Scenario 4: 10-tons-per-day reduction in NOx emissions (Reduce 10 Tons)
Scenario 5: Phase I and II reductions—5.6 tons reductions from 2006-2008 inclusive, plus additional 2 tons reduction from 2008 onward. (Phase I & II Plans)

Figure 3.A.: Future RTC-Reduction Scenarios, 2004-2013 (Tons of NOx)

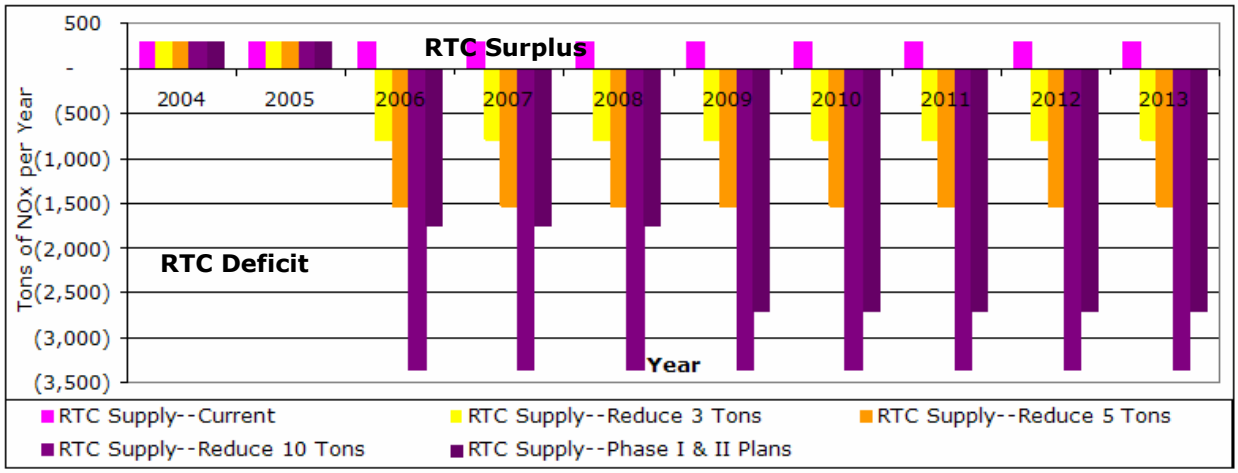


Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm)

In the projections, future NOx emissions are stable, because the emissions do not include the emissions growth from power plants. As such, starting in 2006, the RTC surplus or deficit remains stable throughout the years under analysis. As is apparent from Figure 3.B., starting in year 2006, the NOx emission levels will surpass the RTC supply for every scenario, with the exception of *Scenario 1* (Current). The RTC deficit ranges from 807 tons per year for *Scenario 2* (Reduce 3 Tons) to 3,362 tons per year for *Scenario 4* (Reduce 10 Tons) for years 2006-

2013.[2] Again, for these projections, we assume that the participants will not take any additional actions to curb their emissions. Clearly, the deficits could have potentially significant impacts on the market behavior of the participants. However, when we include control systems in future scenarios, the projections look more optimistic, especially for the years 2010-2013, when the full control measures are implemented, which we discuss next.

Figure 3.B.: Future RTC Deficit and Surplus Scenarios—Without Control Measures, 2004-2013 (Tons of NOx)



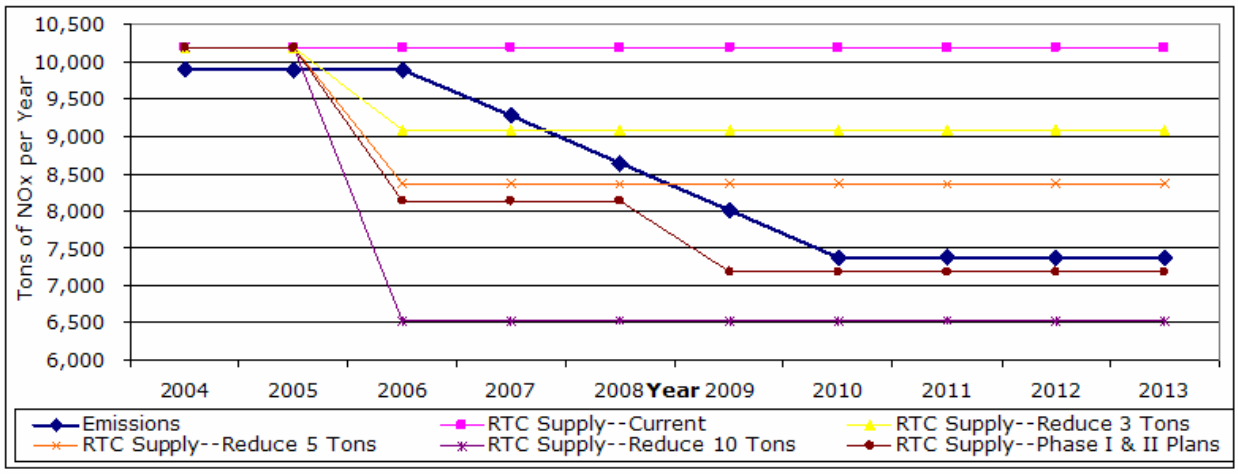
Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm)

4. RTC-Reduction Scenarios with Control Measures—Staggered Introduction of Control Equipment

In this section, we present the above scenarios with the assumption that the participants install control measures, staggered evenly across four years, starting with year 2006 and completed by 2010.

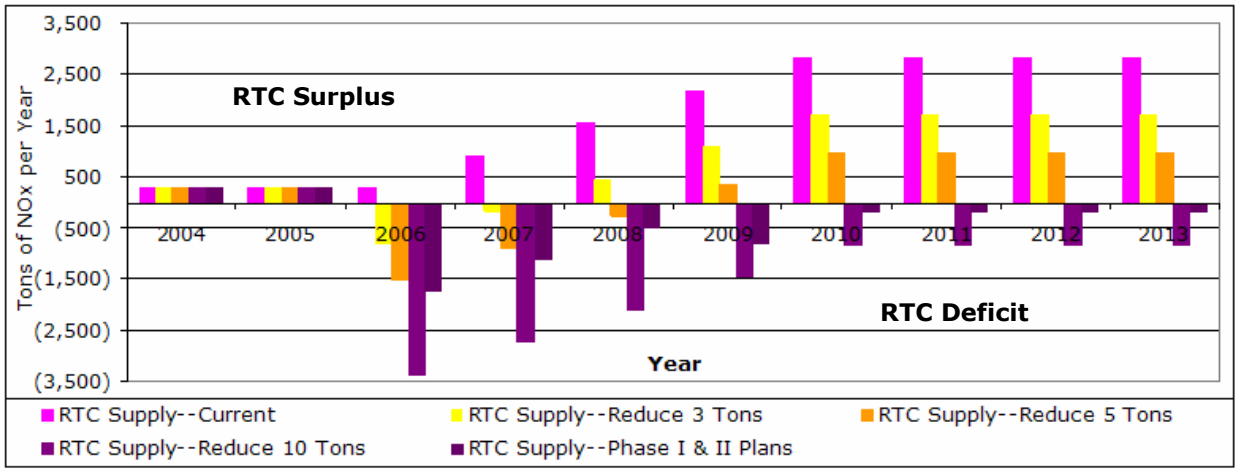
[2] These figures are based on the tables in the Appendix. The exact quantities in the analysis are based on the numbers in these tables.

Figure 4.A.: Future RTC-Reduction Scenarios with Growth Projections and Control Measures 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html).

Figure 4.B.: Future RTC Deficit and Surplus Scenarios—Control Measures 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html).

Once all the facilities have installed the control equipment by the year 2010, their inclusion will have a significant impact on the overall emission levels for all scenarios. Once fully implemented (2010), the total reduction in emissions will amount to 6.9 tons of NOx per day (2,518.5 tons of NOx per year), staggered across four years, resulting in a reduction of 629.6 tons of NOx per year for years 2007, 2008, 2009, and 2010. The following are the summary findings from the above figure:

- For the base years 2004 and 2005, RTC supply will surpass NOx emissions in every scenario, by 288 tons of NOx per year (0.8 tons per day).

- For the years 2006 and 2007, NOx emissions will surpass the RTC supply for every scenario, with the exception of *Scenario 1* (Current). For 2006, the deficit in RTC supply is quite significant, ranging, from over 807 tons of NOx per year for *Scenario 2* (Reduce 3 Tons), to over 3,360 tons of NOx per year for *Scenario 4* (Reduce 10 Tons), while for 2007, the deficit ranges from 177 tons of NOx for *Scenario 2* to over 2,730 for *Scenario 4*. The difference in deficit between the two years is equal to the reduction in emissions in 2007 because of the introduction of control measures, which is 630 tons of NOx for every scenario.

- For the year 2008, the NOx emissions surpasses RTC supply for every scenario with the exception of *Scenario 1* (Current), and *Scenario 2* (Reduce 3 Tons). The surplus for *Scenarios 1* and *2* ranges from 453 tons of NOx for *Scenario 2* to 1,548 tons of NOx for *Scenario 1*. At the same time, the deficit associated with *Scenarios 3*, *4*, and *5* are 277, 2,102, and 496 tons of NOx respectively.

- For the remaining years (2009-2013), all scenarios result in an RTC surplus, with the exception of *Scenario 4 (*Reduce 10 Tons) and *Scenario 5* (Phase I & II-Plans). During these years, the surplus ranges from 350 to over 2,800 tons of NOx per year, while the deficits range from 186 to 1,472 tons of NOx per year.

From this analysis, we determine that the different RTC-reduction scenarios under consideration can result in significant differences in the RTC market. As such, we find that *Scenario 4* (Reduce 10 Tons) and *Scenario 5* (Phase I & II plans) will result in a deficit in the RTC market for every year under analysis, and as such, if selected, must contain provisions about mechanisms to stabilize future RTC prices, which it does in the case of Phase I and II plans.[3] The second conclusion from the above analysis is that once the control mechanisms are fully implemented, the possible options expand significantly. In fact, starting in 2009, the Board could implement all of the above plans, with the exception of *Scenarios 4 or 5*, without a possible RTC price hike. However, for 2006 and 2007, the Board's options are much more limited. As such, the choices for the Board are:

1. Accelerate the implementation of the control mechanisms;

[3] The NOx reductions are proposed to be implemented in two phases. Phase I would achieve 5.4 tons per day (or 15.8 percent) reduction in equal increments of current RTC holdings from compliance years 2006 to 2008, inclusive. Phase II would achieve an additional 2.0 tons per day (or 5.8 percent) reduction in equal increments from compliance years 2009 to 2010, inclusive. This would reflect a net reduction of 21.6 percent. While Phase I reductions would be credited as NOx reductions under the California SIP, Phase II reductions would be retained by facilities as restricted credits for use only if the average RTC price, based on a 12-month rolling average, exceeds $15,000 per ton during either the 2009 or 2010 compliance years. In the event this occurs, Phase II credits would no longer be restricted, and the holders of the credits would have full market use of them. If the average credit prices do not exceed $15,000 per ton, then the reductions achieved for those compliance years would be counted as part of the overall region's progress towards attainment. For year 2011 and subsequent years, all NOx RTC holdings as of date of the rule amendment would be reduced by 21.6 percent. If the $15,000 per ton level is exceeded, the RTC holdings for years 2011 and subsequent years will be adjusted accordingly to match the total percent reductions achieved from 2006 and 2010, inclusive.

2. Decrease the RTC supply on an incremental basis, continuing with current RTC supply through 2007, adopt *Scenario 2* (Reduce 3 Tons) for 2008, and *Scenario 3* (Reduce 3 Tons) for 2009 and beyond.

The Board can also choose a combination of the above plans.

5. Allowing Power Plants in RECLAIM: 2000-2001 Electric-Generation Levels ("Worst Case" Projections)

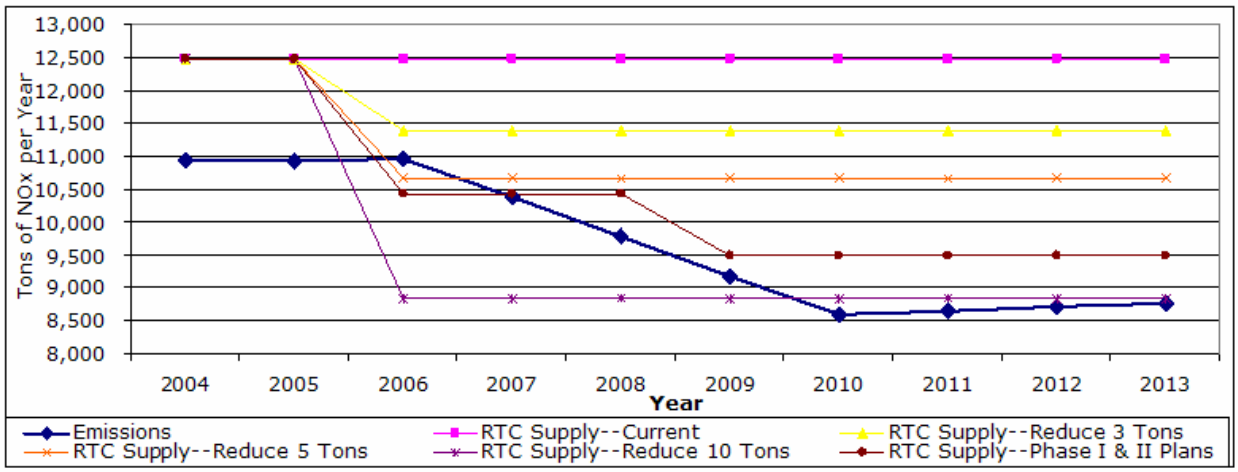
In this section, we extend the findings from Section 4, and allow power plants to reenter the RECLAIM market under "Worst Case" power-generation projections, that is, the power generation will match the amount during the California Energy Crisis, in 2000 and 2001. In this scenario, we show that power plants' NOx emissions will grow from 2.919 tons of NOx per day (1,065 tons of NOx per year) in 2006, to 3.336 tons of NOx per day in 2010 (1,217 tons of NOx per year), to 3.794 tons of NOx per day in 2013 (1,384 tons of NOx per year). These quantities are represented by the Blue Diamond line in the following figures. We have assumed a linear growth in NOx emissions for the middle years (2007, 2008, 2009, 2011, and 2012) where no data are available. Similar to the above analysis, we assume that the reduction in emissions as the result of control measures result in emission reductions of 630 tons of NOx per year for four years, starting in 2007.

Similar to the previous scenarios, where NOx emissions were significantly decreasing (Section 4), because of the implementation of control equipment, in this case, NOx emissions also decrease between 2007 and 2010. The primary reason for this decrease is that the amount of reductions in NOx emissions as the result of control measures is greater than the additional emissions that are generated by the power plants as they re-enter the RECLAIM market. Overall, there is a slight increase in emissions in 2006, the first year power plants are allowed back into the RECLAIM market, and before any of the control measures reduce the overall NOx emission levels. From 2007 to 2010, there is a steady decrease in emission levels, suggesting that the growth in NOx emissions from power plants during the years is less than the reductions in NOx from the control measures. However, from 2010 to 2013, there is a slight, but steady increase in NOx emissions as the result of growth in emissions from the power plants, as well as the fact that by 2010, all of the control measures are already implemented.

As power plants are re-introduced to the RECLAIM market, the RTC supply levels also increase. The RTC supply increases by 18.4 percent for every scenario under analysis, increasing from 10,184 tons of NOx to 12,483 tons of NOx for *Scenario 1* (Current Supply). This increase in the current RTC supply has a cascading effect on all the remaining scenarios, resulting in similar increases in RTC supply for *Scenarios 2* to *5*. This increase in RTC supply is more than the increase in emissions as the result of the reentry of power plants into the RECLAIM market. As such, and as is apparent from Figures 5.A. and 5.B., there are more scenarios where the RTC supply exceeds NOx emissions, and the extent of the surplus is greater than without the power plants in the RECLAIM market. The following are the findings from this analysis:

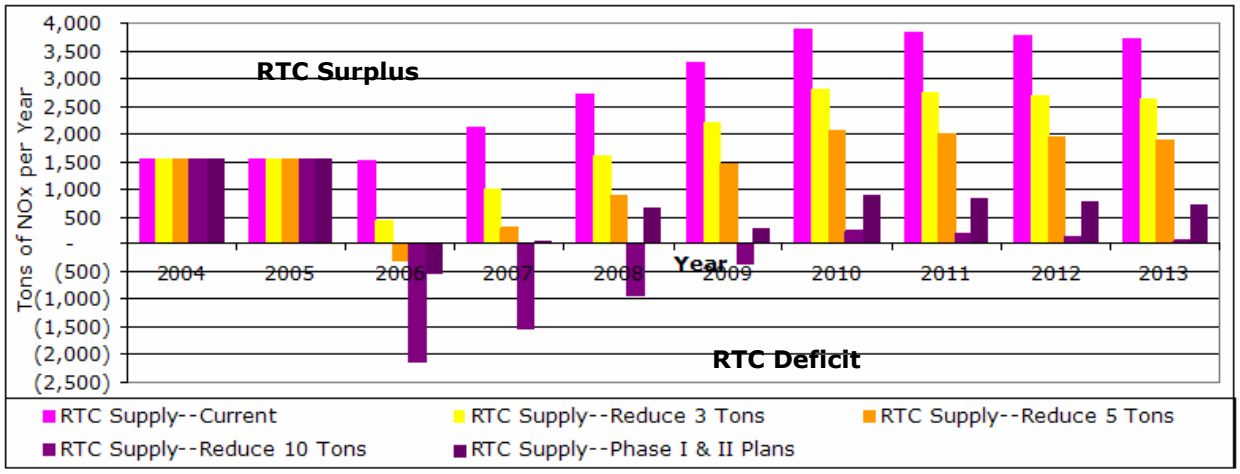
- For year 2006, before any of the benefits from the control measures are realized, the "Worst Case" projections result in RTC deficits for every scenario under analysis with the exception of *Scenario 1* (Current Supply) and *Scenario 2* (Reduce 3 Tons). The RTC deficits range from 303 tons of NOx per year for *Scenario 3* (Reduce 5 Tons) to deficits of over 2,100 tons of NOx per year for *Scenario 4* (Reduce 10 Tons), while the surplus associated with *Scenario 1* and *Scenario 2* is 1,522 and 427 tons of NOx respectively.

Figure 5.A.: Future RTC-Trading Scenarios with Power Plants Generating Power at the 2000-2001 levels (Worst Case), 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Figure 5.B.: Future RTC Deficit and Surplus Scenarios - Power Plants Generating Power at the 2000-2001 levels (Worst Case), 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html);

Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

- For years 2007, 2008, and 2009, when the benefits of the control measures start to offset some of the growth in emissions from the power plants, *Scenarios 1, 2*, *3*, and *5* result in an RTC surplus, while *Scenario 4* results in a deficit. The range of surplus is from 70 tons of NOx per year (0.19 tons per day) for *Scenario 5* in year 2007, to 3,297 tons of NOx per year (9.0 tons per day) for *Scenario 1* for 2009. Alternatively, the RTC deficits for *Scenario 4* (Reduce 10 Tons) are 1,536, 945, and 353 tons of NOx for 2007, 2008, and 2009 respectively.

- For the years 2010-2013, *all* scenarios under analysis result in RTC surplus. This is primarily due to the fact that by 2010, all the reductions from the control measures have been implemented. As such, for all the scenarios under analysis, the greatest RTC surplus is for 2010, after which, the RTC surplus decreases as the growth in emissions from the power plants erodes the amount of RTC surplus. The surplus for 2010 ranges from 3,885 tons of NOx per year (10.6 tons of NOx per day) for *Scenario 1* (Current RTC) to 235 tons of NOx per year (0.6 tons of NOx per day) for *Scenario 4* (Reduce 10 Tons). At the same time, by 2013 the RTC surpluses decrease to 3,718 tons of NOx per year for *Scenario 1*, and 68 tons of NOx per year for *Scenario 4*.

- For the years 2007-2009, the RTC allocation and emissions closely match each other for *Scenario 5* (Phase I and II plans), while for the years 2010-2013, the RTC allocation and emissions closely match each other for *Scenario 4* (Reduce 10 tons). In all these cases, the RTC surplus is a small percentage of the total RTC supply, ranging from 0.6 to 3.0 percent for *Scenario 5* for the years 2007-2009, and from 0.7 to 2.0 percent for *Scenario 4* for the years 2010 to 2013, respectively.

The above results show that the choice of the RTC-reduction plan by the Board would have a significant impact on the RTC market, particularly for the years 2006-2009, where the choice could result in RTC deficit. The most stringent of the plans (*Scenarios 4*) would result in significant RTC deficits for the years 2005 to 2009, while the least stringent plans (*Scenarios 1 and 2*), would result in an RTC surplus for all the years under analysis. As such, adopting the most stringent RTC-reduction plans could result in a significant price hike for RTCs (based on the experiences of the RTC market during the California energy crisis), while the implementation of the least stringent plans would not take advantage of the opportunities that are present to reduce the number of RTCs in the RECLAIM market. However, a combination of implementing *Scenario 5* for years 2007 to 2009 and *Scenario 4* for 2010 and 2013, could provide the Board with an RTC-reduction plan that could closely match the demand needs of the RECLAIM market with the RTC supply. However, the adoption of this plan would require close monitoring of the RTC market to make certain that the small, but anticipated, RTC deficits do not result in RTC price hikes.

6. Allowing Power Plants in RECLAIM: Average Electric-Power Generation Scenarios

In this Section, we assume "average" future power generation by the power plants. In this case, we project that power plants will emit 2.412 tons of NOx per day (880 tons of NOx per year) in 2006, to 2.901 tons of NOx per day in 2010 (1,059 tons of NOx per year), to 3.418 tons of NOx per day in 2013 (1,248 tons of NOx per year). From 2006 to 2010, when the control measures are being implemented, there is a steady decrease in the overall emissions. Alternatively and similar to the analysis in Section 5, for the years 2010-2013, the additional NOx emissions from the power plants after all the control measures have already been implemented results in a steady, but small, increase in NOx emissions during these years.

The more realistic assumptions of future power generation in this case result in only a small change in the overall future RTC-market scenarios:

- For year 2006, *Scenarios 1* and *2* result in RTC surplus, while *Scenarios 3, 4*, and *5* result in RTC deficit. The surplus is 1,707 tons of NOx for *Scenario 1*, and 602 tons of NOx for *Scenario 2*, while the deficit ranges from 118 tons of NOx per year for *Scenario 3* to 1,943 tons of NOx for *Scenario 4*.

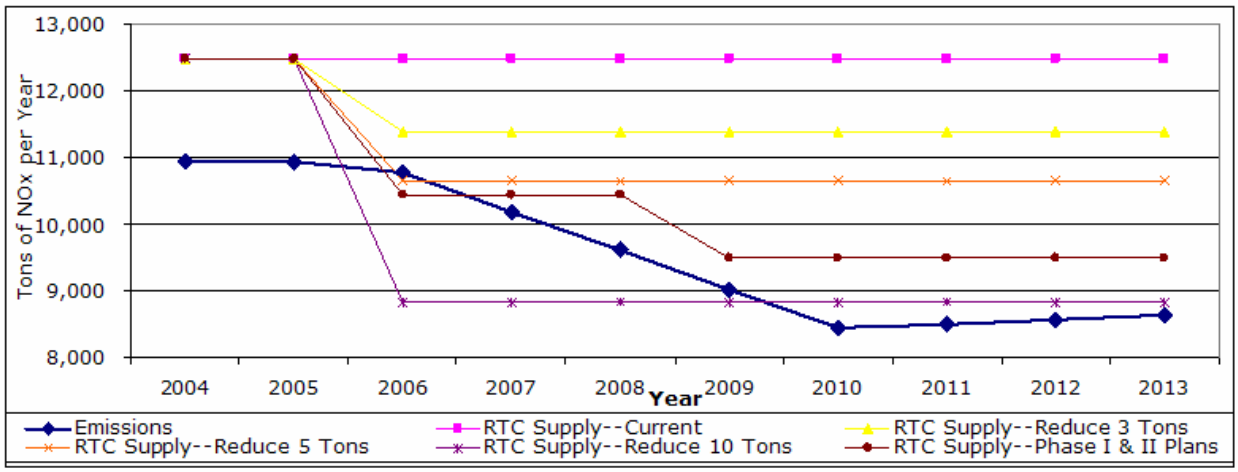
- *Scenarios 1, 2, 3*, and *5* result in RTC surplus for every year from 2007 to 2013. The surplus ranges from 248 tons of NOx per year (0.7 tons of NOx per day) for *Scenario 5* in 2007 to 4,044 tons of NOx per year (11.1 tons of NOx per day) for *Scenario 1* in 2010.

- *Scenario 4* (Reduce 10 tons) results in an RTC deficit for years 2006-2009, with the deficit ranging from 187 tons of NOx per year for 2009 (0.5 tons of NOx per day) to 1,943 tons of NOx per year for 2006 (5.3 tons of NOx per day). Alternatively, implementation of *Scenario 4* results in a surplus for the years 2010-2013, with the surplus ranging from 205 tons of NOx per year (0.65 tons per day) to 394 tons of NOx per year (1.1 tons per day).

- Given the above results, it is apparent that for the years 2010 to 2013, the implementation of any of the scenarios under consideration will result in an RTC surplus, greatly increasing Board's flexibility in adopting a plan.

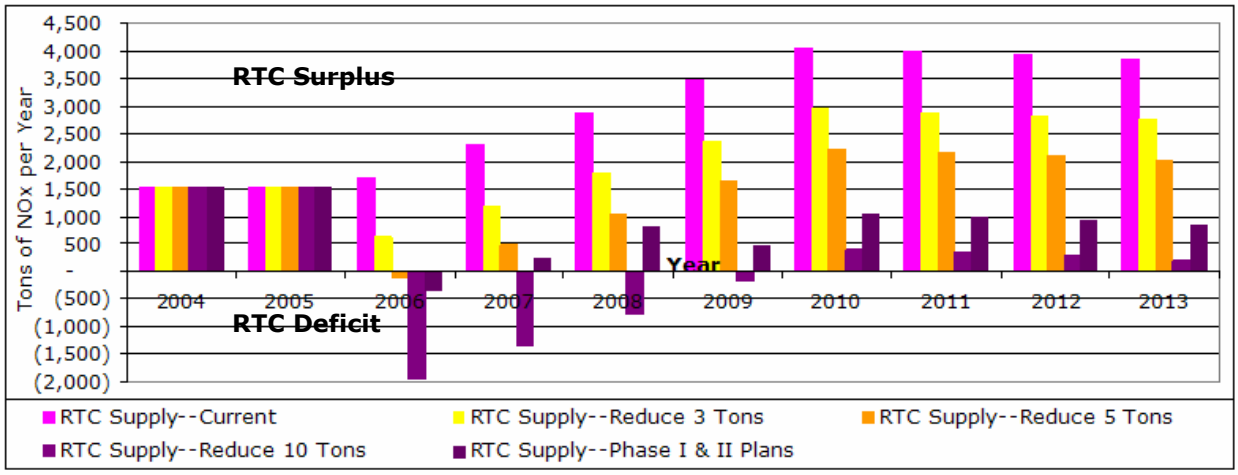
The "Worst Case" power projections differ from the "Average Case" projection mainly in terms of the level of RTC deficits and surpluses for each scenario. As such, we reach similar conclusions for the two power projections. Therefore, even for an "Average Case" power projection, a combination of implementing *Scenario 4* for years 2010 to 2013 and *Scenario 5* for 2007-2009 could provide the Board with an RTC-reduction plan that could closely match the RECLAIM market demand with the RTC supply.

Figure 6.A.: Future RTC-Trading Scenarios with Power Plants Generating Power at Projected Levels (Average Case), 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Figure 6.B.: Future RTC Deficit and Surplus Scenarios with Power Plants Generating Power at Projected Levels (Average Case), 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

7. Levels of Restriction in Power-Plant Participation

So far, we have shown that a laissez-faire re-introduction of power plants into the RECLAIM market could have a significant impact on the most stringent of the possible NOx-reduction scenarios that are currently being considered by SCAQMD, particularly under the "Worst Case" power production projections. Given the historical precedence of the large impact of the California energy crisis on the price of RTCs, we assume that for future scenarios, the Board must take care not to create any circumstances that may result in the same type of price hikes. It is difficult to predict future RTC price scenarios. Even so, given the possible RTC deficits, we assume that the price of RTCs will increase and that they may even surpass the $15,000 per ton of NOx that will result in a review of the RECLAIM market by the Board. As such, depending on the RTC-reduction scenario it adopts, and the power-production projections, we suggest that SCAQMD consider allowing power plants to reenter the RECLAIM market with certain, but small, levels of restrictions. The following are two possible plans of re-entry by the power plants.

Plan 1–Incremental Re-entry:

In this case, SCAQMD allows a percentage of power plants back into the RECLAIM market in order to insure that the RTC supply does not surpass the increased demand. The total number of power plants that are allowed back in will depend on the RTC-reduction scenario the SCAQMD Board adopts. In order to simplify the analysis, in all of the following tables, we assume that the 14 plants under consideration for re-entry emit equal amounts of NOx. Tables 7.A. and 7.B. show

the summary results for the above power-generation projections, RTC-reduction scenarios:

Table 7.A.: Power-Plant Admission Levels into RECLAIM–"Worst-Case" Demand Projections and Proposed RTC-Reduction Scenarios (number of plants)[4]

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	All 14 Plants	All 14 Plants	11 Plants	**0 Plant**	9 Plants
2007	All 14 Plants	All 14 Plants	All 14 Plants	**0 Plant**	All 14 Plants
2008	All 14 Plants	All 14 Plants	All 14 Plants	5 Plants	All 14 Plants
2009	All 14 Plants	All 14 Plants	All 14 Plants	10 Plants	All 14 Plants
2010	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2011	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2012	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2013	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 7.B.: Power-Plant Admission Levels into RECLAIM–"Average" Demand Projections and Proposed RTC-Reduction Scenarios (number of plants)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	All 14 Plants	All 14 Plants	All 14 Plants	**0 Plant**	All 14 Plants
2007	All 14 Plants	All 14 Plants	All 14 Plants	1 Plant	All 14 Plants
2008	All 14 Plants	All 14 Plants	All 14 Plants	9 Plants	All 14 Plants
2009	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2010	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2011	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2012	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants
2013	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants	All 14 Plants

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Tables 7.A. and 7.B. show that regardless of future levels of power generation, some or all power plants can be allowed to reenter the RECLAIM market under all scenarios, with the exception of *Scenario 4* (Reduce 10 tons) for the year 2006, in which case *none* of the plants can re-enter the RECLAIM market without resulting in RTC deficits. However, under the remaining plans, a percentage of power plants can be admitted into the RECLAIM market that would not result in an RTC-credit deficit, and in a majority of cases, all of the power plants can be allowed to re-enter

[4] For all the tables referring to incremental or percentage re-entry of power plants into RECLAIM, please refer to Appendix A for the exact number of power plants that can be allowed back into RECLAIM. In a majority of cases, the number of plants that can re-enter is greater than 14, implying that, in those cases, there is a great deal of flexibility in future re-entry of additional power plants, if needed.

the RECLAIM market. The following are the summary results of the power-plant re-entry scenarios from these tables:

- Under *Scenario 1* (current supply), all power plants can re-enter RECLAIM market for every year under analysis regardless of future power generation levels. The same holds true for *Scenario 2* (Reduce 3 tons).

- Under *Scenario 3* (Reduce 5 tons), for the "Worst" case power projections, all 14 power plants can re-enter RECLAIM for every year with the exception of 2006, in which case 11 power plants can re-enter RECLAIM market. Under the "Average" power projections, all power plants can re-enter RECLAIM for every year under analysis (2006-2013).

- Under *Scenario 4* (Reduce 10 tons), all 14 power plants can reenter RECLAIM market for the years 2010-2013 under the "Worst Case" projections, and for the years 2009-2013 under the "Average Case" projections. Alternatively, no power plants can reenter RECLAIM for the years 2006 and 2007 for the "Worst Case" projections, and none can reenter RECLAIM during 2006 under "Average Case" projections. A proportion of plants can reenter RECLAIM for the remaining years under either case.

- Under *Scenario 5*, all power plants can reenter RECLAIM under "Average Case" projections for every year under analysis, and with the exception of 2006, all power plants can reenter RECLAIM under "Worst Case" projections, during which only 9 power plants can reenter RECLAIM.

The advantages of incremental re-entry are fourfold.

1. The SCAQMD Board can select plants to re-enter the RECLAIM market based on the steps the plant has already taken to reduce their NOx emissions and, as such, can provide an incentive for the power plants to meet and exceed their emission levels. Therefore, the conditions that are set for the power plants to re-enter the RECLAIM market can be used to improve power-plant emission levels.

2. Incremental re-entry allows the Board to examine carefully the effects of power-plant re-entry on the RTC market, and to react accordingly, without the fear of out-of-control price increases, as was the case during the California energy crisis.

3. Incremental re-entry will also allow the Board to implement some of the more stringent RTC-reduction scenarios that they are considering.

4. It establishes a clear and transparent system for the power plants to follow. As such, the SCAQMD Board can clearly articulate the criteria for power plants to be selected to re-enter the RECLAIM market and to adjust the numbers based on actual emission rates and RTC market conditions. It is very important to have a transparent system in place before power plants are allowed back into the RECLAIM market, and incremental re-entry will allow for such a transparent system to co-exist with the need for RTC reduction plans and stable RTC prices.

Plan 2–Percent-Emission Re-entry:

Under this plan, all 14 power plants are allowed to re-enter the RECLAIM market, but only a percentage of their total emission levels will be part of the RECLAIM market. Tables 7.C. and 7.D. show the percentage of the power-plant NOx emissions that can be traded through RTC trading.

Table 7.C.: Power-Plant Admission Levels into RECLAIM–"Worst-Case" Supply and Demand Scenario
(% Emissions Allowed to Re-Enter RECLAIM market)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	100%	100%	78%	**0%**	63%
2007	100%	100%	100%	**0%**	100%
2008	100%	100%	100%	32%	100%
2009	100%	100%	100%	75%	100%
2010	100%	100%	100%	100%	100%
2011	100%	100%	100%	100%	100%
2012	100%	100%	100%	100%	100%
2013	100%	100%	100%	100%	100%

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD mp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 7.D.: Power-Plant Admission Levels into RECLAIM–"Average-Case" Supply and Demand Scenarios
(% Emissions Allowed to Re-Enter RECLAIM market)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	100%	100%	100%	**0%**	100%
2007	100%	100%	100%	4%	100%
2008	100%	100%	100%	67%	100%
2009	100%	100%	100%	100%	100%
2010	100%	100%	100%	100%	100%
2011	100%	100%	100%	100%	100%
2012	100%	100%	100%	100%	100%
2013	100%	100%	100%	100%	100%

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

The results from Tables 7.C. and 7.D. mirror those from Tables 7.A. and 7.B. respectively, because they are based on the same analysis. Overall, the primary motivation behind Plan 2 is the same as Plan 1: To have a stable RTC market as new power plants reenter the RECLAIM market, while reducing the overall emission levels, through the reduction of available RTCs in the market. The primary difference between the two plans is in regards to the difficulty of monitoring and managing the RTC market. The primary disadvantage of Plan 2 is that it will be

more difficult to monitor the level of RTC trading by power plants in a situation where part of their emission is controlled through traditional command-and-control means and the remainder is controlled through the RTC trading market, than in Plan 1. For the power plants themselves, the difficulty will be to adjust to a dual system of emission monitoring. As such, given the difficulties associated with the Scenario 2, the incremental re-entry of power plants into RECLAIM is a more feasible and practical option.

8. Market Stability in the Event that a BARCT Analysis is Performed Every Three Years with the Potential for Additional Reductions

The above finding shows that depending on the RTC-reduction scenario, the number of power plants that can re-enter the RECLAIM market can vary dramatically, and in a number of cases, there is a potential for the RTC deficit to be so large as to make it prohibitive to allow *any* power plants to re-enter the market (*Scenario 4*). As such, the possibility that additional BARCT analysis may result in further reduction in RTC-credit supply could result in unexpected RTC deficits. However, by considering the following two options, the Board may mitigate some of the unforeseen market fluctuations:

1. Incremental Re-entry: As stated above, incremental re-entry of power plants will allow the Board to adjust to unforeseen market fluctuations, including the need to reduce RTC levels because of BARCT analysis. This option allows the Board to build in some contingencies to reflect future BARCT adjustments, which decreases the likelihood that future RTC reductions can result in RTC deficits.

2. BARCT Opt-Out Option: As we show later in this report, allowing plants to opt-out of the RECLAIM market once they have reached BARCT or BACT levels, gives the Board tremendous flexibility in reducing the number of RTC credits in the RECLAIM market. This option is an appropriate method of adjusting to future RTC reductions as the result of a 3-year BARCT analysis. Under this plan, if future BARCT analysis shows the need for further RTC reductions as is required by law, the Board can allow the BARCT facilities in the RECLAIM market to exit and remove their allocated RTCs from the market, resulting in the required RTC reduction.

Combined, the above two plans give the Board the flexibility to decrease RTC levels when needed, and it allows the plants to stay within RECLAIM or opt-out based on their needs.

9. Potential Impact - RECLAIM Facilities Opt Out of RECLAIM

Given the above results, the potential for removing 7 percent of RECLAIM facilities at BACT or BARCT levels would provide SCAQMD more flexibility in choosing the most appropriate RTC-reduction scenarios. However, it is important to note that there is a corresponding reduction in RTCs as qualified facilities opt out of RECLAIM

that match their emissions, and as such, although the possibility to opt out of RECLAIM increases the flexibility of managing the RECLAIM market by SCAQMD, the overall RTC surplus and deficit does not change significantly as a result of introducing this option. That is because the proportion of RTC supply and RTC demand (NOx emission), remain the same for all the scenarios under analysis. The result of this analysis is shown in Figures 9.A. and 9.B., and Tables 9.A and 9.B.

Figure 9.A.: Future RTC Deficit and Surplus Scenarios, with BARCT Facilities Opting Out—Power Plants Generating Power at the 2000-2001 levels (Worst Case), 2004-2013 (Tons of NOx)

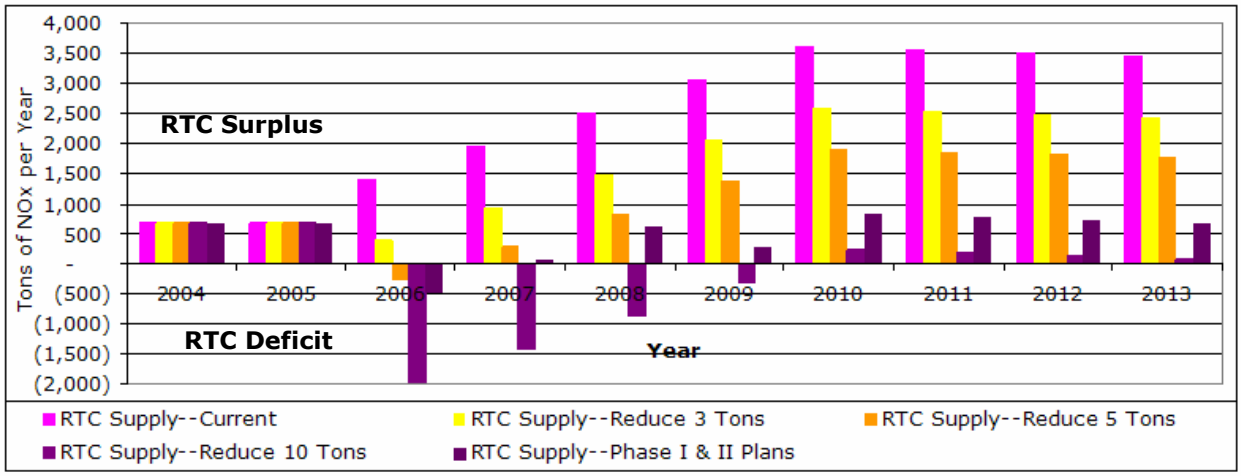
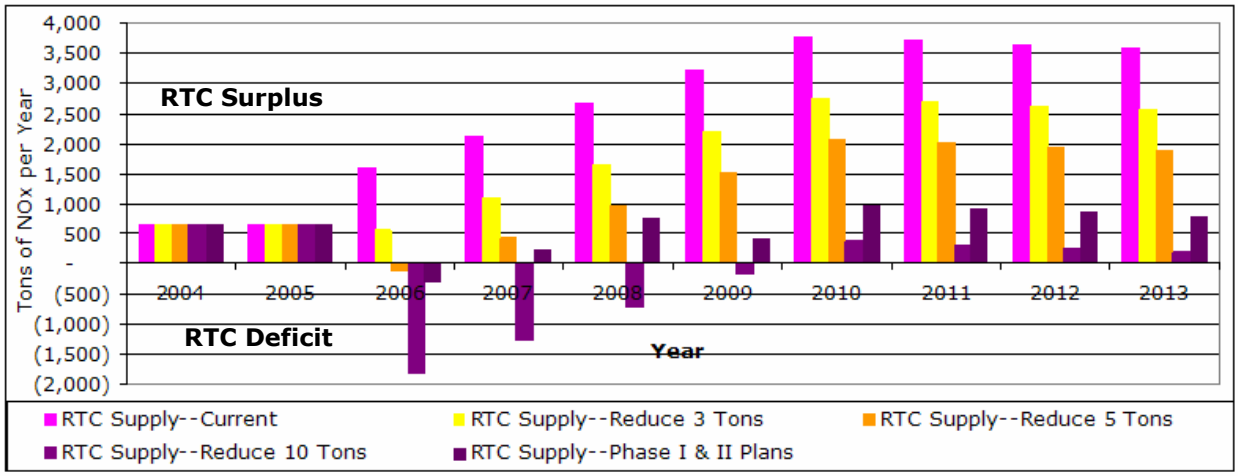


Figure 9.B.: Future RTC Deficit and Surplus Scenarios, with BARCT Facilities Opting Out—Power Plants Generating Power at Projected levels (Average Case), 2004-2013 (Tons of NOx)



Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 9.A.: Number of Power Plants that can Re-Enter RECLAIM Market–Future Power-Generation Projections–BARCT and BACT Facilities Opting Out, 2004-2013 (Number of Plants)

	RTC SUPPLY CURRENT		RTC SUPPLY REDUCE 3 TONS		RTC SUPPLY REDUCE 5 TONS		RTC SUPPLY REDUCE 10 TONS		RTC SUPPLY PHASE I & II PLANS	
	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection
2006	14	14	14	14	11	13	**0**	**0**	9	11
2007	14	14	14	14	14	14	**0**	1	14	14
2008	14	14	14	14	14	14	5	7	14	14
2009	14	14	14	14	14	14	11	12	14	14
2010	14	14	14	14	14	14	14	14	14	14
2011	14	14	14	14	14	14	14	14	14	14
2012	14	14	14	14	14	14	14	14	14	14
2013	14	14	14	14	14	14	14	14	14	14

Table 9.B.: Percent NOx Emissions that can Re-Enter RECLAIM Market–Future Power-Generation Projections–BARCT and BACT Facilities Opting Out, 2004-2013 (Percent NOx)

	RTC SUPPLY CURRENT		RTC SUPPLY REDUCE 3 TONS		RTC SUPPLY REDUCE 5 TONS		RTC SUPPLY REDUCE 10 TONS		RTC SUPPLY PHASE I & II PLANS	
	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection
2006	100%	100%	100%	100%	80%	92%	**0%**	**0%**	65%	78%
2007	100%	100%	100%	100%	100%	100%	**0%**	9%	100%	100%
2008	100%	100%	100%	100%	100%	100%	37%	49%	100%	100%
2009	100%	100%	100%	100%	100%	100%	76%	88%	100%	100%
2010	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2011	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2012	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2013	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

As is apparent from the above tables and figures, by allowing BARCT and BACT facilities to opt out of the RECLAIM market, we change the number of power plants that can enter the RECLAIM market slightly. As such, all power plants can re-enter RECLAIM under *Scenarios 1, 2*, and *3* for either projections for all the years under analysis, with the exception of *Scenario 3* for the year 2006, where 11 and 13 power plants can reenter RECLAIM for "Worst Case" and "Average Case" projections respectively. Furthermore, under *Scenario 4* (Reduce 10 Tons), no power plant can reenter RECLAIM for years 2006 and 2007 under "Worst Case" projection, and zero or one power plant can reenter RECLAIM for the two year under the "Average Case" projections. Finally, all power plants can reenter RECLAIM under Scenario 5 (Phase I & II Plans) for either projections, with the exception of 2006, when 9 or 11 power plants can reenter RECLAIM for "Worst Case" and "Average Case" projections respectively. Overall, the above results closely mirror the findings from Section 7, where the BARCT and BACT facilities did not have the option of exiting the RECLAIM

market. Given the minimal impact and increased flexibility of introducing this option to the RECLAIM market, it seems feasible to include it in future plans when power plants are allowed back into the RECLAIM market.

10. RTC Reductions Options: (1) Across-The-Board Reductions, or (2) Individual Facility Reductions Based On Their Nox Emission Reductions Per Equipment

We can consider two options for RTC reductions. Option 1 is an across-the-board reduction, while for Option 2 individual facilities reduce RTCs based on their Nox emission reductions per equipment. When analysts calculate potential cost savings and technology innovation from the pollution-abatement changes, they assume that facilities are able to make numerous requests from the market. Inherent in those cost-saving predictions is the assumption that a market with certain qualities will arise.

To minimize transactions and search costs, to increase efficiency and cost savings, and to establish the market signals necessary to guide innovative technological development, a plant manager should have access to a central, efficient, highly advanced market. In many cases, the requirements the manager may ask of this market far exceed those of financial markets, because (1) it is prohibitively costly to change capital improvements to reduce emissions once underway; (2) facility plant managers often need to buy a large number of items, for which the purchase of one item necessitates the purchase of another; and (3) emissions markets are very sparse and do not have a well-established set of market values. In addition, although regulators have largely desired a "hands-off" approach to the development of a market, the rules, regulation, and administrative procedures in an emissions-trading program can have profound effects upon the realization of this efficient market. The establishment of ownership records and efficient tracking and updating of these records is crucial to the ability to standardize the emissions credits for trading. Without standardization, efficient auction markets cannot arise.

Too often, analysts tend to ignore transaction costs and the obstacle(s) they present to more efficient levels of emissions trading. Following Cheung's (1975) definition of transaction costs as factors that prevent markets from operating efficiently, or as factors that prevent markets from forming at all, in the emissions-trading context, these can be defined more specifically as:

- search costs,
- negotiation costs,
- regulatory and market risk,
- monitoring costs,
- enforcement costs,
- insurance costs,
- credit discounting, and
- geographic restrictions

(Bohi and Butraw 1992; Solomon and Rose 1992; Dudek and Wiener 1996).

Although a trading system can be less costly than a command-and-control system (because of the flexibility provided to firms regarding the technical means of pollution control), transaction costs indirectly add to aggregate control costs (Stavins 1995). If an emissions-trading system is new or is being applied to new problems, program-implementation costs can become a significant consideration. These include the costs of initially designing the program, gathering the needed baseline data and other information, and negotiating program parameters with affected parties.

Overall then, the efficacy of an emissions market is mainly a function of whether the amount of emissions is reduced in an efficient and timely manner. Given the geographical scope and mandate of the RECLAIM market, that is, for the market to be as effective as the BACT system on the aggregate level, it is imperative for RECLAIM to have as efficient and cost-effective of an abatement policy as possible. As such, it is reasonable to assume that a system where the reductions are monitored across the board (Option 1) would be more efficient, less costly, and simpler to enforce, than a system where reductions are tracked at the facility and equipment level (Option 2).

11. Summary Analysis

The following is a summary analysis of the above findings:

- An analysis of RTCs historical transactions shows that RTC current transactions constitute a small portion of the overall RTC market and, as such, open-market RTCs represent contingency credits that augment the respondents' allocated RTCs. We assume that participants will continue to look for internal answers to their emissions' needs and use the RTC market mainly as an auxiliary solution to meet emission levels.

- Given the historical precedence of the California Energy Crisis, where the spike in RTC demand resulted in a significant price hike for RTCs, all future plans for RTC reduction and re-introduction of power plants into the RECLAIM market must be taken into account so that the RTC demand does not surpass RTC supply.

- Without the re-entry of power plants to the RECLAIM market, the RTC-reduction scenarios could result in an RTC deficit for all of the scenarios under analysis, with the exception of *Scenario* 1 (Current Supply). The introduction of control measures increases the number of scenarios that do not result in a significant RTC deficit, allowing the Board to choose from *Scenarios 1, 2,* or *3*, from 2009 to 2013.

- Although the re-introduction of power plants into RECLAIM market will significantly increase the RTC demand, the 18.4 percent increase in the RTC supply for all scenarios, will result in lowering the deficits and increasing the surpluses associated with all the scenarios. As such, SCAQMD will have more options for selecting a scenario that does not result in RTC deficits, particularly for the "Average Case" power projections.

- Given the possibility of an RTC price under some of the more stringent scenarios (*Scenarios 4* and *5*), the SCAQMD could make plans to allow the power plants back into the RECLAIM market on an incremental basis. There are two options for the incremental re-introduction: Plan 1: Allow a percentage of power plants to re-enter the market based on their emission levels and adjust the numbers according to the RTC supply and demand scenarios. Plan 2: Allow all power plants to re-enter the RECLAIM market, but permit only a portion of their NOx emissions to be included in the RECLAIM market. In either plan, the amount of additional NOx emissions that are introduced into the RECLAIM market must remain below the number of available RTC permits in the Market.

- Given the added complexity of Plan 2 above, Plan 1 is a more cost-effective and transparent system to implement than Plan 2, and it will give the Board more flexibility in adjusting the RTC supply and demand projections.

- Finally, a plan to allow BACT and BARCT facilities to opt out of RECLAIM will further increase the flexibility on the part of the Board to make certain that the RTC supply and demand do not result in RTC deficits. In addition, by combining the ability of plants to opt-out with the three-year BARCT review to adjust RTC levels, the Board can incrementally decrease the supply of RTCs, while insuring that the RECLAIM market remains stable, and the RTC demand does not surpass the supply.

Appendix A: Detailed Tables

Table A.1. shows the NOx emission scenarios with and without the power plants, while Table A.2. shows the reductions associated with full implementation of the control measures.

In all of the other tables, the table number refers to the figure within the body of the analysis that these data support. For example, the following Table 3.A. contains the data for Figure 3.A. in the analysis. All of the following calculations are based on the data in the base tables.

Table A.1.: Future NOx Emission Projections – (1) Without Power Plants, (2) With Power Plants Generating at "Worst-Case" Projections, and (3) With Power Plants Generating at "Average-Case" Projections (Tons of NOx per Year)

	WITHOUT POWER PLANTS	WITH POWER PLANTS – WORST CASE PROJECTIONS	WITH POWER PLANTS – AVERAGE CASE PROJECTIONS
2004	**9,896**	**10,943**	**10,943**
2005	**9,896**	**10,943**	**10,943**
2006	**9,896**	**10,961**	**10,776**
2007	**9,896**	*10,999*	*10,821*
2008	**9,896**	*11,038*	*10,866*
2009	**9,896**	*11,076*	*10,910*
2010	**9,896**	**11,114**	**10,955**
2011	**9,896**	*11,170*	*11,018*
2012	**9,896**	*11,225*	*11,081*
2013	**9,896**	**11,281**	**11,144**

Note: The numbers in bold represent the data that were provided; the numbers in italics represent the data that were calculated based on linear growth projections for each scenario. The above data are based on the following assumptions: 1. No growth in NOx emissions for scenarios where power plants are not allowed into RECLAIM; 2. For "Worst Case" projections, additional NOx emissions of 2.919 tons of NOx per day for 2006, 3.336 additional tons of NOx per day for 2010, and 3.794 tons of NOx per day for 2013. For the "Average Case" projections, those growth numbers are, 2.412 tons of NOx per day for 2006, 2.901 tons of NOx per day for 2010, and 3.418 tons of NOx per day for 2013.

Table A.2.: The Reduction in NOx as the Result of Implementation of Control Measures (Tons of NOx per Year)

	REDUCTION IN NOX
2004	0
2005	0
2006	0
2007	630
2008	630
2009	630
2010	629
2011	0
2012	0
2013	0
Total	2,519

Note: The numbers above are based on the total reduction of 6.9 tons of NOx per day. We spread the implementation of the control measures across four years, starting in 2006, and as such the full benefits are not realized until 2010.

Table 3.A. (for Figure 3.A): Future RTC-Reduction Scenarios, 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004	9,896	10,184	10,184	10,184	10,184	10,184
2005	9,896	10,184	10,184	10,184	10,184	10,184
2006	9,896	10,184	9,089	8,359	6,534	8,140
2007	9,896	10,184	9,089	8,359	6,534	8,140
2008	9,896	10,184	9,089	8,359	6,534	8,140
2009	9,896	10,184	9,089	8,359	6,534	7,191
2010	9,896	10,184	9,089	8,359	6,534	7,191
2011	9,896	10,184	9,089	8,359	6,534	7,191
2012	9,896	10,184	9,089	8,359	6,534	7,191
2013	9,896	10,184	9,089	8,359	6,534	7,191

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm)

Table 3.B. (for Figure 3.B): Future RTC Deficit and Surplus Scenarios – Without Control Measures 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004		288	288	288	288	288
2005		288	288	288	288	288
2006		288	**(807)**	**(1,537)**	**(3,362)**	**(1,756)**
2007		288	**(807)**	**(1,537)**	**(3,362)**	**(1,756)**
2008		288	**(807)**	**(1,537)**	**(3,362)**	**(1,756)**
2009		288	**(807)**	**(1,537)**	**(3,362)**	**(2,705)**
2010		288	**(807)**	**(1,537)**	**(3,362)**	**(2,705)**
2011		288	**(807)**	**(1,537)**	**(3,362)**	**(2,705)**
2012		288	**(807)**	**(1,537)**	**(3,362)**	**(2,705)**
2013		288	**(807)**	**(1,537)**	**(3,362)**	**(2,705)**

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm)

Table 4.A. (for Figure 4.A): Future RTC-Reduction Scenarios with Control Measures 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004	9,896	10,184	10,184	10,184	10,184	10,184
2005	9,896	10,184	10,184	10,184	10,184	10,184
2006	9,896	10,184	9,089	8,359	6,534	8,140
2007	9,266	10,184	9,089	8,359	6,534	8,140
2008	8,636	10,184	9,089	8,359	6,534	8,140
2009	8,006	10,184	9,089	8,359	6,534	7,191
2010	7,377	10,184	9,089	8,359	6,534	7,191
2011	7,377	10,184	9,089	8,359	6,534	7,191
2012	7,377	10,184	9,089	8,359	6,534	7,191
2013	7,377	10,184	9,089	8,359	6,534	7,191

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html).

Table 4.B. (for Figure 4.B): Future RTC Deficit and Surplus Scenarios - Control Measures 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004		288	288	288	288	288
2005		288	288	288	288	288
2006		288	**(807)**	**(1,537)**	**(3,362)**	**(1,756)**
2007		918	**(177)**	**(907)**	**(2,732)**	**(1,126)**
2008		1,548	453	**(277)**	**(2,102)**	**(496)**
2009		2,178	1,083	353	**(1,472)**	**(815)**
2010		2,807	1,712	982	**(843)**	**(186)**
2011		2,807	1,712	982	**(843)**	**(186)**
2012		2,807	1,712	982	**(843)**	**(186)**
2013		2,807	1,712	982	**(843)**	**(186)**

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html).

Table 5.A. (for Figure 5.A): Future RTC-Trading Scenarios with Power Plants Generating Power at the 2000-2001 levels (Worst Case), 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004	10,943	12,483	12,483	12,483	12,483	12,483
2005	10,943	12,483	12,483	12,483	12,483	12,483
2006	10,961	12,483	11,388	10,658	8,833	10,439
2007	10,369	12,483	11,388	10,658	8,833	10,439
2008	9,778	12,483	11,388	10,658	8,833	10,439
2009	9,186	12,483	11,388	10,658	8,833	9,490
2010	8,598	12,483	11,388	10,658	8,833	9,490
2011	8,654	12,483	11,388	10,658	8,833	9,490
2012	8,709	12,483	11,388	10,658	8,833	9,490
2013	8,765	12,483	11,388	10,658	8,833	9,490

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 5.B. (for Figure 5.B): Future RTC Deficit and Surplus Scenarios - Power Plants Generating Power at the 2000-2001 levels, 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004		1,540	1,540	1,540	1,540	1,540
2005		1,540	1,540	1,540	1,540	1,540
2006		1,522	427	**(303)**	**(2,128)**	**(522)**
2007		2,114	1,019	289	**(1,536)**	70
2008		2,706	1,611	881	**(945)**	662
2009		3,297	2,202	1,472	**(353)**	304
2010		3,885	2,790	2,060	235	892
2011		3,829	2,734	2,004	179	836
2012		3,774	2,679	1,949	124	781
2013		3,718	2,623	1,893	68	725

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 6.A. (for Figure 6.A): Future RTC-Trading Scenarios with Power Plants Generating Power at Average Levels, 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004	10,943	12,483	12,483	12,483	12,483	12,483
2005	10,943	12,483	12,483	12,483	12,483	12,483
2006	10,776	12,483	11,388	10,658	8,833	10,439
2007	10,191	12,483	11,388	10,658	8,833	10,439
2008	9,606	12,483	11,388	10,658	8,833	10,439
2009	9,020	12,483	11,388	10,658	8,833	9,490
2010	8,439	12,483	11,388	10,658	8,833	9,490
2011	8,502	12,483	11,388	10,658	8,833	9,490
2012	8,565	12,483	11,388	10,658	8,833	9,490
2013	8,628	12,483	11,388	10,658	8,833	9,490

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 6.B. (for Figure 6.B): Future RTC Deficit and Surplus Scenarios with Power Plants Generating Power at Projected Levels, 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004		1,540	1,540	1,540	1,540	1,540
2005		1,540	1,540	1,540	1,540	1,540
2006		1,707	612	**(118)**	**(1,943)**	**(337)**
2007		2,292	1,197	467	**(1,358)**	248
2008		2,878	1,783	1,053	**(773)**	834
2009		3,463	2,368	1,638	**(187)**	470
2010		4,044	2,949	2,219	394	1,051
2011		3,981	2,886	2,156	331	988
2012		3,918	2,823	2,093	268	925
2013		3,855	2,760	2,030	205	862

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 7.A. (for Table 7.A.): Power-Plant Admission Levels into RECLAIM– "Worst-Case" Demand Projections and Proposed RTC-Reduction Scenarios (number of plants)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	29	18	11	**(7)**	9
2007	35	24	17	**(1)**	15
2008	41	30	23	5	21
2009	47	36	29	10	17
2010	53	42	35	16	23
2011	52	41	34	16	22
2012	52	41	34	15	22
2013	51	40	33	15	21

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 7.B.: Power-Plant Admission Levels into RECLAIM–"Average" Demand Projections and Proposed RTC-Reduction Scenarios (number of plants)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	46	30	19	**(8)**	16
2007	55	39	28	1	25
2008	64	48	37	9	33
2009	73	56	45	18	28
2010	81	65	54	27	37
2011	80	64	53	26	36
2012	80	63	52	25	35
2013	79	62	51	24	34

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 7.C.: Power-Plant Admission Levels into RECLAIM–"Worst-Case" Supply and Demand Scenario (% Emissions Allowed to Re-Enter RECLAIM market)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	209%	131%	78%	**-53%**	63%
2007	252%	173%	121%	**-10%**	105%
2008	294%	215%	163%	32%	147%
2009	336%	258%	206%	75%	122%
2010	378%	300%	248%	117%	164%
2011	375%	296%	244%	113%	160%
2012	371%	292%	240%	109%	156%
2013	367%	288%	236%	105%	152%

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD mp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 7.D.: Power-Plant Admission Levels into RECLAIM–"Average-Case" Supply and Demand Scenarios (% Emissions Allowed to Re-Enter RECLAIM market)

	RTC SUPPLY CURRENT	RTC SUPPLY REDUCE 3 TONS	RTC SUPPLY REDUCE 5 TONS	RTC SUPPLY REDUCE 10 TONS	RTC SUPPLY PHASE I & II PLANS
2006	332%	215%	137%	**-59%**	113%
2007	394%	277%	199%	4%	176%
2008	457%	340%	262%	67%	238%
2009	520%	402%	324%	129%	199%
2010	582%	465%	387%	191%	262%
2011	575%	458%	380%	185%	255%
2012	568%	451%	373%	178%	248%
2013	561%	444%	366%	171%	241%

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 9.A. (For Table 9.A.): Number of Power Plants that can Re-Enter RECLAIM Market–Future Power-Generation Projections–BARCT and BACT Facilities Opting Out, 2004-2013 (Number of Plants)

	RTC SUPPLY CURRENT		RTC SUPPLY REDUCE 3 TONS		RTC SUPPLY REDUCE 5 TONS		RTC SUPPLY REDUCE 10 TONS		RTC SUPPLY PHASE I & II PLANS	
	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection
2006	28	30	18	20	11	13	**-6**	**-4**	9	11
2007	34	35	24	25	17	18	**0**	1	15	16
2008	39	41	29	31	22	24	5	7	20	22
2009	45	46	35	36	28	29	11	12	17	18
2010	50	52	40	42	33	35	16	18	22	24
2011	50	51	40	41	33	34	16	17	22	23
2012	49	51	39	40	32	34	15	17	21	23
2013	49	50	38	40	32	33	15	16	21	22

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 9.B. (For Table 9.B.): Percent NOx Emissions that can Re-Enter RECLAIM Market–Future Power-Generation Projections–BARCT and BACT Facilities Opting Out, 2004-2013 (Percent NOx)

	RTC SUPPLY CURRENT		RTC SUPPLY REDUCE 3 TONS		RTC SUPPLY REDUCE 5 TONS		RTC SUPPLY REDUCE 10 TONS		RTC SUPPLY PHASE I & II PLANS	
	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection	Worst Case Projection	Average Growth Projection
2006	201%	214%	128%	141%	80%	92%	**-42%**	**-30%**	65%	78%
2007	241%	253%	168%	180%	119%	131%	**-2%**	9%	105%	117%
2008	280%	292%	207%	219%	159%	170%	37%	49%	144%	156%
2009	320%	331%	247%	258%	198%	209%	76%	88%	120%	131%
2010	359%	370%	286%	297%	237%	248%	116%	126%	159%	170%
2011	355%	365%	282%	292%	234%	244%	112%	122%	156%	166%
2012	352%	361%	279%	288%	230%	240%	108%	118%	152%	162%
2013	348%	357%	275%	284%	226%	235%	105%	114%	148%	157%

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 9.C. (for Figure 9.A): Future RTC Deficit and Surplus Scenarios, with BARCT Facilities Opting Out—Worst Case Power Generation, 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004		666	666	666	666	666
2005		666	666	666	666	666
2006		1,415	397	**(282)**	**(1,979)**	**(485)**
2007		1,966	947	269	**(1,429)**	65
2008		2,516	1,498	819	**(878)**	615
2009		3,066	2,048	1,369	**(328)**	283
2010		3,613	2,595	1,916	219	830
2011		3,561	2,543	1,864	167	778
2012		3,510	2,491	1,812	115	726
2013		3,458	2,439	1,760	63	674

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

Table 9.D. (for Figure 9.B): Future RTC Deficit and Surplus Scenarios, with BARCT Facilities Opting Out—Average Power Generation, 2004-2013 (Tons of NOx)

	EMISSIONS	RTC SUPPLY-CURRENT	RTC SUPPLY-REDUCE 3 TONS	RTC SUPPLY-REDUCE 5 TONS	RTC SUPPLY-REDUCE 10 TONS	PHASE I & II PLANS
2004		666	666	666	666	666
2005		666	666	666	666	666
2006		1,588	569	**(110)**	**(1,807)**	**(313)**
2007		2,132	1,113	435	**(1,263)**	231
2008		2,676	1,658	979	**(718)**	775
2009		3,220	2,202	1,523	**(174)**	437
2010		3,761	2,743	2,064	366	977
2011		3,702	2,684	2,005	308	919
2012		3,644	2,625	1,946	249	860
2013		3,585	2,567	1,888	191	802

Sources: SCAQMD Audit Report (http://www.aqmd.gov/hb/040435a.html); SCAQMD Regional Growth Assumptions (http://www.aqmd.gov/aqmp/AQMD03AQMP.htm); SCAQMD Future Installation of Control Equipment (http://www.aqmd.gov/hb/001040a.html); Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program (http://www.aqmd.gov/hb/2003/030639a.html).

References

Bohi, D.R., and D. Burtraw. 1992. Utility Investment Behavior and the Emission Trading Market. R*esources and Energy* **14**:129-153.

Chueng, S.N. 1975. Transaction Costs, Rick Aversion and the Choice of Contractual Arrangements. *Journal of Law and Economics* **18**: 535-554.

Dudek, D.J., and J.B. Wiener. 1996. Joint Implementation, Transaction Costs, and Climate Change. *OECD/GD* **96**(173), pp. 123-127.

SCAQMD Audit Report, available: http://www.aqmd.gov/hb/040435a.html.

SCAQMD Regional Growth Assumptions, available http://www.aqmd.gov/aqmp/AQMD03AQMP.htm.

SCAQMD Future Installation of Control Equipment, available: http://www.aqmd.gov/hb/001040a.html.

Recommendations Regarding Reentry of Power Producing Facilities into RECLAIM Program, available: http://www.aqmd.gov/hb/2003/030639a.html.

SCAQMD Audit Report, available: http://www.aqmd.gov/hb/040435a.html.

SCAQMD Regional Growth Assumptions, available: http://www.aqmd.gov/aqmp/AQMD03AQMP.htm.

SCAQMD RTC Trade Information, available: http://www.aqmd.gov/reclaim/rtc_main.html.

Solomon, B.D., and K. Rose. 1992. Making a Market for SO2 Emissions Trading. *Electricity Journal* **56**: 58-66.

Stavins, R.N. 1995. Transaction Costs and Tradable Permits. *Journal of Environment and Economic Management* **292**:133-148.