This table represents NOx control costs concerning Reasonably Available Control Technology (RACT) determinations for existing stationary sources as determined by each state and corrected for inflation to December 2021 US dollars. In addition to RACT, states may also be applying controls for attainment planning and to mitigate interstate air pollution transport. These cost analyses may be based on varying underlying data due to different local and facility-specific conditions, such as cost of materials, utilization rates, potential or actual reductions, and finance interest rates (e.g., bonds and discount rates). Varying underlying data may result in different costs--even when the same level of control is applied in a specific source category. Therefore, these control costs do not necessarily represent the level of pollution controls required by each state. For more information about the underlying data, see the state technical support documents compiled by the workgroup.

OTC SAS – RACT TOOL[1]
Cost Effectiveness for NOx Emissions from Existing Sources
(All numbers in $/ton of NOx Removed)

#	Source Category	New Jersey	Delaware	Maryland	New York	Connecticut	Pennsylvania	High	Low	Average
1	Large Boilers	6,363[2]	6,000[3]	17,669[4] (coal)[5,6]	6,000[7]	13,635[8]	EPA FIP[9]	17,669	6,000	9,933
2	Industrial, Commercial and Institutional Boilers	6,363[10]	6,000		6,000	13,635	7,500[9]	13,635	6,000	7,900
3	Municipal Solid Waste Incinerators	3,881[11]	6,000	6,495[12]	6,000	13,635[13]	3,750[9]	13,635	3,750	6,627
4	Turbines	5,599[14]	6,000		6,000	13,635	7,500[9]	13,635	5,599	7,747
5	Asphalt Production	25,770[15]	6,000		6,000	13,635		25,770	6,000	12,851
6	Glass Furnaces	2,386[16]	6,000		6,000	13,635	3,750[9]	13,635	2,386	6,354
7	Engines[17]	15,394[18]	6,000		6,000	13,635	3,750[9]	15,394	3,750	8,956

[1] *Note that Massachusetts is in attainment for ozone and under the Clean Air Act any state in the Ozone Transport Region needs to develop equivalent NOx RACT emission limits. Massachusetts relied on the State of New York's cost analysis to support Massachusetts' NOx RACT II development.* The RACT cost effectiveness numbers of OTC states are converted to 2021 US dollars using the United States Bureau of Labor statistics CPI Inflation Calculator available at https://www.bls.gov/data/inflation_calculator.htm.

[2] The estimated cost effectiveness for HEDD boilers is approximately $600 to $18000 per ton of NOx removed with an average of $5000 per ton of NOx removed (August 2008 dollars). $1250/ton of NOx removed for installing, maintaining and operating SCR system on coal fired boiler (2007 dollars). (Please see page 77, 78 and 102 of the of August 4, 2008 New Jersey RACT rule proposal, available at *https://www.nj.gov/dep/rules/proposals/080408a.pdf,* and Response to comment 24, page 16 through 18 of New Jersey adoption document available at https://www.nj.gov/dep/rules/adoptions/adopt_090420.pdf).

[3] The way Delaware has addressed RACT, which is by incorporating it into regulations, makes most cases presumptive so the cost doesn't usually end up factoring in until we hit our minor new source review level (5 tpy), which requires BACT. Delaware has recommended $5,000/ton as a standard to EPA. That recommendation was developed in 2013 so increasing to 2021 values that number would go up to ~$6,000/ton.

[4] Maryland Department of the Environment, "Facts About…COMAR 26.11.38 - Control of NOx Emissions from Coal-Fired Electric Generating Units," October 3, 2014. The cost-effectiveness average value of $15,604 from 2014 was converted to 2021 dollars using the CPI.

[5] Maryland Department of the Environment, "Technical Support Document for COMAR 26.11.38 – Control of NOx Emissions from Coal-Fired Electric Generating Units," December 3, 2014.

[6] Maryland Department of the Environment, "Appendix B Maryland Healthy Air Act Notice of Proposed Action," March 7, 2007.

[7] New York RACT is based on a 1994 $3,000.00 per ton value that has been increased to $6,000.00 per ton based on inflationary calculation. This number only applies to case-by-case/alternative RACT determinations. Facilities may choose to install controls based on regulatory presumptive RACT limits cited in the New York RACT regulations for each source category.

[8] See: RCSA section 22a-174-22e at the below link. Specifically, within that regulation, the cost threshold is referenced in subsection (h)(1)(A)(iii). The cost-effectiveness value of $13,635 in 2019 dollars when converted to 2021 dollars using the CPI is $15,102. However, the workgroup has not included the converted dollar value since there is no mechanism for adjusting the cost in the CT regulation. RCSA section 22a-174-22e is available here: eRegulations - Browse Regulations of Connecticut State Agencies.

[9] EPA issued the final FIP on August 31, 2022 to address RACT II requirements for coal-fired EGUs equipped with SCR. See Fed. Reg. 53,381. The PA DEP used RACT III cost-effectiveness benchmarks of $3,750 to establish presumptive NOx emission limits and $7,500 will be used as a screening tool to evaluate whether RACT II determinations may assure compliance with RACT III. See 46 Pa.B. 2044 (April 23, 2016).

[10] The annual cost-effectiveness varies from $600.00 per ton to $18,000 per ton, In general for most scenarios, $5000 per ton. (Please see Page 78 of August 4, 2008 New Jersey RACT rule proposal, available at *https://www.nj.gov/dep/rules/proposals/080408a.pdf and* Response to comment 97, page 64 of New Jersey adoption document available at https://www.nj.gov/dep/rules/adoptions/adopt_090420.pdf).

[11] The cost of $2,917 per ton of NOx removed (April 2009 dollars). (Please see Response to comment 114, page 74 of New Jersey adoption document available at https://www.nj.gov/dep/rules/adoptions/adopt_090420.pdf).

[12] Capital and operating costs are from Babcock Power Environmental, "Waste to Energy NOx Feasibility Study," February 20, 2020. Calculated dollars per ton of NOx reduced are from the Ozone Transport Commission, "Municipal Waste Combustor Workgroup Report," April 2022, see https://otcair.org/upload/Documents/Reports/MWC%20Report_revised%2020220425.pdf .

[13] Although the municipal waste combustors in Connecticut are not subject to the emission limits of RCSA section 22a-174-22e, CT DEEP holds them to the same level of cost effectiveness for NOx RACT because they exceed even the electric generating units in NOx emissions.

[14] The cost effectiveness for installing water injection on HEDD unit is $44,000 per ton of NOx removed. This cost-effectiveness estimate is ozone-season based, not an annual value. The total replacement cost including maintenance and operation of simple cycle combustion turbine ranges from 0.5 to 0.8 million per MW. (Page 78 of August 4, 2008 New Jersey RACT rule proposal, available at *https://www.nj.gov/dep/rules/proposals/080408a.pdf).* If the HEDD unit is operated 365 days per year, the annualized cost effectiveness would be about one-tenth of the estimated $44,000 or $4,400 per ton of NOx removed. *(*Please see Response to comment 42, page 27 of New Jersey adoption document available at https://www.nj.gov/dep/rules/adoptions/adopt_090420.pdf).

The cost effectiveness of installing water injection plus SCR and CO catalyst is approximately $10,200/ton of NOx removed. (Please see Response to comment 43, page 27 of New Jersey adoption document available at https://www.nj.gov/dep/rules/adoptions/adopt_090420.pdf).

For simple cycle turbines combusting natural gas and compressing gaseous fuel, the cost effectiveness is $7,033/ton to $18,983/ton for selective catalytic reduction. (Please see Table D, Page 68 of January 3, 2017 proposal available at *https://www.nj.gov/dep/rules/proposals/20170103a.pdf).*

[15]The cost effectiveness to upgrade or retrofit to be in the range of $2500 to $38000 per ton of NOx removed. A calculated average value of $20,250 (August 2008 dollars) is specified in this table. (Please see Page 75 of August 4, 2008 New Jersey RACT rule proposal, available at *https://www.nj.gov/dep/rules/proposals/080408a.pdf).*

The technologies that are available to achieve the NOx emission concentrations at N.J.A.C. 7:27-19.9 are retrofitting an existing burner with flue gas recirculation (FGR) and upgrading a burner to a low-NOx burner. Based on an equipment life of 10 years, the Department estimated the cost to be $100,000 for the FGR package and installation, including upgrading the computer-based control, and $50,000 to upgrade an existing burner to a low NOx burner system. Lower cost alternatives, such as implementation of best management practices are feasible for some plants. The Department expected upgrades and retrofits to improve production efficiency, which results in fuel savings and reduced annual emission fees due to more efficient dryer operation. In addition, significant fuel savings are expected from adopting best management practices. These cost savings have not been accounted for in the above cost estimates.

[16] The cost effectiveness of installing oxyfiring in the range of $1,250-2,500/ton. A calculated average value of $1875 is specified in this table.*(*Please see Page 77 of August 4, 2008 New Jersey RACT rule proposal, available at *https://www.nj.gov/dep/rules/proposals/080408a.pdf).*

[17] Engines are used in industrial, institutional, and commercial facilities and types are varied. OTR states established different emissions limits based upon size of the engine, type of fuel used (liquid or gaseous fuel), actual use of the engine (electricity generation, transmission of natural gas in pipelines, etc.) and whether the engine is a rich-burn engine or lean-burn engine.

[18] Cost effectiveness for installing Selective catalytic reduction on engines 200 bhp to 500 bhp combusting natural gas and compressing gaseous fuel. A calculated average value of $13,408 is specified in this table. Please see Table F, Page 72 of January 3, 2017 proposal available at *https://www.nj.gov/dep/rules/proposals/20170103a.pdf.*