

ATTACHMENT NRG-1
Consent Order No. 8377



STATE OF CONNECTICUT)	
)	Consent Order #8377
AND)	
)	
MIDDLETOWN POWER LLC)	
MONTVILLE POWER LLC)	
CONNECTICUT JET POWER LLC)	
DEVON POWER LLC)	
)	

CONSENT ORDER

WHEREAS, the Commissioner of Energy & Environmental Protection (Commissioner) and Middletown Power LLC, Montville Power LLC, Connecticut Jet Power LLC, and Devon Power LLC (collectively referred to as NRG Connecticut) agree that the Commissioner may issue an order to establish case-by-case Reasonably Available Control Technology (RACT) for Nitrogen Oxide (NOx) emissions in accordance with Section 22a-174-22e(h) of the Regulations of Connecticut State Agencies (RCSA) as a method of compliance with RCSA Section 22a-174-22e(d):

- A. At the request and with the agreement of NRG Connecticut, the Commissioner finds the following:
 - 1. NRG Connecticut owns and operates electric generation facilities in Connecticut (premises). At these premises NRG Connecticut owns and operates emissions units that supply power to the ISO New England electric power grid and are subject to RCSA Section 22a-174-22e pertaining to the control of NOx emissions.
 - 2. In accordance with Section 22a-174-22e(h)(1), an owner or operator may request the Commissioner's approval for a case-by-case emissions limit for an emissions unit if the owner or operator demonstrates to the Commissioner's satisfaction that an emissions limit of RCSA Section 22a-174-22e(d) is not economically or technically feasible for the emissions unit.
 - 3. In accordance with RCSA Section 22a-174-22e(h)(2), a request for a case-by-case NOx RACT determination shall be submitted to the commissioner for review no later than January 1, 2021 for a Phase 2 emissions limit.
 - 4. On March 20, 2019, NRG Connecticut submitted applications requesting the Commissioner's approval of a Phase 2 case-by-case NOx RACT emissions limit for the emissions units described in Table A.1. At the request of the Commissioner, additional submissions were made on April 11, 2019 and June 28, 2019.

Table A.1 - Case-by-Case NOx RACT Demonstration Emissions Unit Description		
Unit ID/Location	Unit Description	Permit/ Registration Number
Devon 10 734 Naugatuck Ave, Milford	20 MW P&W FT4A-8 Simple Cycle Turbine	P #105-0026
Middletown 10 1866 River Road, Middletown	20 MW P&W FT4A-8 Simple Cycle Turbine	R #104-0102
Branford 10 272 East Main Street, Branford	20 MW P&W FT4A-8 Simple Cycle Turbine	R #014-0008
Franklin Drive 10 99 Franklin Drive, Torrington	20 MW P&W FT4A-8 Simple Cycle Turbine	R #183-0049
Torrington Terminal 10 1250 South Main Street, Torrington	20 MW P&W FT4A-8 Simple Cycle Turbine	R #183-0059
Montville 10 74 Lathrop Road, Uncasville	2.75 MW Internal Combustion (IC) Engine	R #107-0021
Montville 11 74 Lathrop Road, Uncasville	2.75 MW IC Engine	R #107-0022

5. In accordance with RCSA Section 22a-174-22e(h)(5), concurrent with the request for a case-by-case NOx RACT determination, the owner or operator of an emissions unit that is the subject of the case-by-case demonstration may request the imposition of a limit on the potential NOx emissions or limit on fuel use, raw materials processed or hours of operation for such emissions unit for the Commissioner's review and written approval.
6. NRG Connecticut requested the following limits on allowable fuel combusted:
 - Middletown 10 – 850,000 gallons/year (which is equivalent to 500 hours/year at full load);
 - Devon 10 – 874,000 gallons/year (which is equivalent to 465 hours/year at full load).
7. In accordance with RCSA Section 22a-174-22e(h)(1)(A), a request for a case-by-case NOx RACT determination shall demonstrate that the use of available emissions control technology and each compliance option designated in RCSA Section 22a-174-22e(g) is either technically or economically infeasible for the emissions unit that is the subject of the demonstration. Economic feasibility is determined on a dollar/ton basis, where any value determined using a method approved by the Commissioner that is equal to or less than \$13,635/ton of NOx reduced for a Phase 2 demonstration is presumed economically feasible.

8. In accordance with RCSA Section 22a-174-22e(g)(4), the following compliance options are available for a simple cycle turbine:
 - Install and operate water injection technology;
 - Reduce the average emission rate by at least 40% from a 2019 baseline; or
 - Retire another unit or units located at the same facility.
9. NRG Connecticut determined that installation of high pressure water injection (HPWI) and selective catalytic reduction (SCR) are technologies capable of lowering the emissions rate of a P&W FT4A-8 turbines by at least 40%. No units were identified that could be retired at the premises where the turbines are located.
10. In accordance with RCSA Section 22a-174-22e(g)(6), the following compliance options are available for an IC engine:
 - Reduce the average emission rate by at least 40% from a 2019 baseline; or
 - Retire another unit or units located at the same facility.
11. NRG Connecticut determined that SCR is a technology capable of lowering the emissions rate of the IC engines by at least 40%. No units located at the Montville facility were identified that could be retired.
12. In accordance with RCSA Section 22a-174-22e(h)(6)(A), an owner or operator shall identify all NOx emission control alternatives available for use on the emissions unit that is the subject of the demonstration.
13. NRG Connecticut determined that SCR and HPWI are the NOx control technologies available for the P&W FT4A-8 turbines and that SCR is the control technology available for the IC engines.
14. In accordance with RCSA Section 22a-174-22e(h)(6)(B), an owner or operator shall eliminate infeasible options from further consideration after identifying the physical, chemical or engineering circumstance that would preclude successful use of the control option.
15. NRG Connecticut determined that SCR is not technically feasible for Middletown 10, Branford 10, Franklin Drive 10 and Torrington Terminal 10 due to lateral and vertical space constraints.
16. In accordance with RCSA Section 22a-174-22e(h)(6)(C), an owner or operator shall evaluate the control effectiveness of feasible alternatives in terms of NOx emissions reduced based on the potential emissions of the emissions unit prior to use of the control alternative.
17. In accordance with RCSA Section 22a-174-22e(h)(6)(D), an owner or operator shall evaluate the cost of each feasible control alternative using a method approved by the Commissioner.

18. In accordance with RCSA Section 22a-174-22e(h)(6)(E), an owner or operator shall evaluate the cost effectiveness of each feasible control alternative on an annual basis as the cost in US dollars per ton of NOx reduced (\$/ton).
19. In accordance with RCSA Section 22a-174-22e(h)(7), the case-by-case NOx RACT determination approved by the commissioner shall be no less stringent than the lowest NOx emission rate achievable from the emissions unit using a cost effective control alternative.
20. NRG Connecticut calculated the NOx reduction efficiency, annualized cost and cost effectiveness for each of the technically feasible control technologies. The annualized cost and cost effectiveness were calculated using the *Air Pollution Control Cost Effectiveness Assessment Template* provided by the Commissioner. The results of these calculations are summarized in Table A.2. Based on these results, NRG Connecticut has demonstrated that the technically feasible control technologies available for the subject emissions units are not economically feasible.

Table A.2 - Summary of Control and Cost Effectiveness Evaluations				
Emissions Unit	Control Technology	Control Effectiveness (%)	Annualized Cost (\$/year)	Cost Effectiveness (\$/ton)
Devon 10	SCR	74.7	\$674,292	\$22,321
	HPWI	60	\$332,304	\$13,699
Middletown 10	HPWI	60	\$334,791	\$14,704
Branford 10	HPWI	60	\$451,252	\$16,237
Franklin Drive 10	HPWI	60	\$468,158	\$15,165
Torrington Terminal 10	HPWI	60	\$460,278	\$14,917
Montville 10	SCR	80.1	\$180,395	\$17,297
Montville 11	SCR	79.3	\$180,151	\$18,178

21. In accordance with RCSA Section 22a-174-22e(h)(1)(B), an owner or operator shall recommend a case-by-case RACT emissions limit that represents the lowest emissions limit reasonable for the emissions unit. An owner or operator may also recommend additional actions that will reduce NOx emissions from stationary or mobile sources in Connecticut.
22. NRG Connecticut proposes to continue operating the subject units without installing NOx controls. To achieve NOx emissions reductions and obtain a net air quality benefit, NRG Connecticut proposes to install and operate NOx emissions control equipment on Montville Unit 5 by January 1, 2020, on Middletown Unit 4 by May 1, 2020 and on Montville Unit 6 by January 1, 2021 and over-control the units to the Phase 2 emissions limits specified in RCSA Section 22a-174-22e(d)(2)(C) during the Phase 1 compliance period.

23. In accordance with RCSA Section 22a-174-22e(h)(1)(C), a case-by-case RACT demonstration shall provide a net air quality benefit including real and quantifiable reductions in NOx emissions from any facility in Connecticut under control of the owner or operator submitting the demonstration. The owner or operator shall calculate the NOx emission reductions achievable by implementing the recommended emissions limit and additional actions and compare that emissions reduction to the NOx emissions reductions that would have occurred if the emissions units complied with the emissions limits specified in RCSA Section 22a-174-22e(d).
24. NRG Connecticut calculated the NOx emissions reductions achievable during the Phase 1 compliance period resulting from implementing the proposal to install and operate NOx emissions controls on Montville Unit 5 by January 1, 2020, on Middletown Unit 4 by May 1, 2020 and on Montville Unit 6 by January 1, 2021 to be 3.4 tons for Montville Unit 5, 16.3 tons for Middletown Unit 4 and 16.9 tons for Montville Unit 6, for a total of 36.7 tons of NOx reductions. NRG Connecticut calculated the NOx emissions reductions that would have occurred if the subject emissions units complied with the emissions limits specified in RCSA Section 22a-174-22e(d) during the Phase 2 compliance period to be 32.6 tons. NRG Connecticut calculated the net air quality benefit of the proposal to be 4 tons of NOx reductions.
25. In accordance with RCSA Section 22a-174-22e(h)(8), the net air quality benefit obtained from the case-by-case RACT determination shall not include the reduction in potential emissions of NOx associated with the imposition of a limit on the potential NOx emissions or a limit on fuel use, raw materials processed or hours of operation.
26. The NOx reduction calculations assume that the dispatch profiles remain similar to those experienced during the 2014 through 2018 time period and did not include the reduction in potential emissions of NOx associated with the imposition of the requested limits on the hours of operation of Middletown 10 and Devon 10.
27. In accordance with RCSA Section 22a-174-22e(h)(9)(A), the owner or operator submitting a request for a case-by-case RACT determination shall, prior to submitting the request, publish notice of such request in a newspaper of general circulation in the area in which the emissions unit operates. The notice must include the information specified in RCSA Section 22a-174-22e(h)(12), including the scheduling of a public informational hearing to be held if any request for such hearing is submitted. RCSA Section 22a-174-22e(h)(10) requires that a copy of the notice be submitted to the Commissioner.
28. In accordance with RCSA Section 22a-174-22e(h)(11), the owner or operator submitting a request for a case-by-case RACT determination shall hold an informational hearing to explain the purpose of and basis for the request if a request to hold such hearing is made.
29. NRG Connecticut certified that notices were published in the newspapers identified in Table A.3.

Municipality	Publication	Date Published	Offered Hearing Date	Hearing Requested?
Devon	Milford Mirror	12/20/2018	1/22/2019	No
Middletown	Middletown Press	12/14/2018	1/15/2019	No
Branford	New Haven Register	12/14/2018	1/21/2019	No
Torrington	Register Citizen	12/14/2018	1/16/2019	No
Montville	The Day	12/14/2018	1/14/2019	No

30. In accordance with RCSA Section 22a-174-22e(h)(9)(B), the owner or operator submitting a request for a case-by-case RACT determination shall, prior to submitting the request, notify the chief elected official of the municipality in which the emissions unit that is the subject of the request is located.
31. In accordance with RCSA Section 22a-174-22e(h)(10), the owner or operator shall include a signed statement certifying that the owner or operator notified the chief elected official of the municipality in which the emissions unit that is the subject of the request is located.
32. NRG Connecticut certified that the chief elected officials identified in Table A.4 were notified of the request for a case-by-case RACT determination. A copy of each chief elected official notification letter was submitted to the Commissioner.

Municipality	Chief Elected Official	Date of Letter	Date of Certification
Devon	Mayor Blake	12/14/2018	3/14/2019
Middletown	Mayor Drew	12/14/2018	3/14/2019
Branford	First Selectman Cosgrove	12/14/2018	3/14/2019
Torrington	Mayor Carbone	12/14/2018	3/14/2019
Montville	Mayor McDaniel	12/14/2018	3/14/2019

33. Based on the information described in Paragraphs A.7 through A.20, the Commissioner finds that NRG Connecticut has demonstrated that the emissions limits specified in RCSA Section 22a-174-22e(d) are not technically and economically feasible for the subject emissions units. The cost effectiveness calculated for the technically feasible control alternatives were greater than \$13,635/ton of NO_x reduced for all the subject units, which is above the threshold for presumed economic feasibility for a Phase 2 demonstration.

34. Based on the information described in Paragraphs A.21 through A.26, the Commissioner finds that NRG Connecticut has demonstrated that the case-by-case NOx RACT proposal achieves a net air quality benefit.
35. Based on the information described in Paragraphs A.27 through A.32, the Commissioner finds that NRG Connecticut has complied with the public participation requirements specified in Subdivisions (9) through (12) of RCSA Section 22a-174-22e(h).
- B. In accordance with RCSA Section 22a-174-22e(h) and Section 22a-174-22e(d)(1)(B) and subject to the provisions of this order, the Commissioner hereby allows NRG Connecticut to operate Devon 10, Middletown 10, Branford 10, Franklin Drive 10, Torrington Terminal 10, Montville 10, and Montville 11 under the case-by-case NOx RACT determinations as specified in Paragraph C.1 of this order.

Other than what is explicitly noted in this order, nothing relieves NRG Connecticut of the responsibility to conduct, maintain and operate the subject emissions units in compliance with all applicable requirements of any federal, municipal or state agency.

- C. With the agreement of NRG Connecticut and pursuant to Sections 22a-6, 22a-171, 22a-174, 22a-176, and 22a-177 of the Connecticut General Statutes, the Commissioner orders as follows:
1. Phase 2 NOx RACT Determination. On and after June 1, 2023, NRG Connecticut shall not cause or allow actual NOx emissions from the operation of the subject emissions units to exceed the emission limits stated in Table C.1. Compliance with the corresponding NOx emissions limits shall be determined based on the results of emissions testing performed in accordance with RCSA Section 22a-174-22e(l). The emissions limits specified in Table C.1 shall constitute NOx RACT for the subject emissions units.

Table C.1 – Phase 2 NOx RACT Determination	
Unit ID	NOx Emissions Limit (pound/MMBtu)
Devon 10	0.74
Middletown 10	0.67
Branford 10	0.8
Franklin Drive 10	0.8
Torrington Terminal 10	0.8
Montville 10	2.61
Montville 11	2.61

2. Limit on Potential Emissions for Middletown 10. Middletown Power shall not combust in Middletown 10 more than 850,000 gallons of fuel during any consecutive 12 month period.

3. Limit on Potential Emissions for Devon 10. Devon Power shall not combust in Devon 10 more than 874,000 gallons of fuel during any consecutive 12 month period.
4. Installation of NOx Controls on Boilers. NRG Connecticut shall install NOx emissions controls on the emissions units described in Table C.2 to control NOx emissions by May 1, 2020 on Middletown Unit 4, by January 1, 2020 on Montville Unit 5 and by January 1, 2021 on Montville Unit 6. Following the installation and tuning of the NOx emissions control system on a boiler, NRG Connecticut shall operate the boiler in compliance with the applicable Phase 2 emissions limits specified in RCSA Section 22a-174-22e(d)(2)(C).

Unit ID/Location	Unit Description	Permit/ Registration Number	Date
Middletown Unit 4 1866 River Road, Middletown	400 MW Utility Boiler	P #104-0003	May 1, 2020
Montville Unit 5 74 Lathrop Road, Uncasville	82 MW Utility Boiler	R #107-0017	January 1, 2020
Montville Unit 6 74 Lathrop Road, Uncasville	402 MW Utility Boiler	R #107-0020	January 1, 2021

5. Optimization of NOx Emissions Controls. After initial start-up following the installation of NOx emissions controls, the Commissioner will allow NRG Connecticut to operate Middletown Unit 4 and Montville Unit 6 for a period of 240 run hours each combusting No. 6 oil to tune the boiler, optimize controls and meet the Phase 2 emissions limit specified in RCSA Section 22a-174-22e(d)(2)(C). The Commissioner will allow NRG Connecticut to operate Montville Unit 5 for a period of 360 run hours combusting No. 6 oil or natural gas (total for both fuels) to tune the boiler, optimize controls and meet the Phase 2 emissions limit specified in RCSA Section 22a-174-22e(d)(2)(C).
6. Baseline Emissions Analysis. If the Commissioner requires that any boiler operate without NOx controls during a stack test, the data collected during the no-control test runs shall not be used to determine compliance with the emissions limits specified in RCSA Section 22a-174-22e(d)(2)(C). NRG Connecticut shall include such emissions when calculating and recording monthly and consecutive 12-month NOx emissions.
7. If NRG Connecticut exceeds the RCSA Section 22a-174-22e(d)(2)(C) emissions limits during boiler operation described in Paragraphs C.5 and C.6 of this order during the NOx RACT Phase 1 period, NRG Connecticut shall retire discrete emissions reduction credits (DERCs) in accordance with Trading Agreement and Order (TAO) #8365, with the

additional stipulation that the Phase 2 emissions limits specified in RSCA Section 22a-174-22e(d)(2)(C) will be used for DERC retirement calculations.

8. Notwithstanding the above, during the Phase 1 period when the Independent System Operator of New England (ISO-NE) declares an actual deficiency of operating reserves requiring implementation of Actions 4, 5, 6, 7, 8 or 9 of Operating Procedure No. 4 - Actions During a Capacity Deficiency (OP-4) or an emergency under Operating Procedure No. 7 - Actions in an Emergency (OP-7) and ISO-NE dispatches a unit listed in Table C.2 of this order, NRG Connecticut may, for the dispatched unit, comply with this order by retiring DERCs in accordance with TAO #8365, with the additional stipulations that NRG Connecticut use the Phase 2 emissions limits specified in RSCA Section 22a-174-22e(d)(2)(C) in the DERC retirement calculations and retire twice the number of DERCs as required under TAO #8365. NRG Connecticut shall operate available NOx emissions controls during such operations except during periods of startup and shutdown.
9. NRG Connecticut shall notify the commissioner, in writing, of the dates of commencement of construction, completion of construction, and initial startup of the urea injection and combustion modification equipment, as applicable, no later than 30 days after the subject event.
10. Recordkeeping and Reporting
 - a. For each emissions unit listed in Table C.1, NRG Connecticut shall by the close of each calendar day record the actual hours of operation and the actual quantity of fuel combusted during the preceding day and shall calculate and record NOx emissions for each emissions unit. NRG Connecticut shall calculate NOx emissions using the emissions rate determined during the latest emissions test performed in accordance with RSCA Section 22a-174-22e(1).
 - b. For each emissions unit listed in Table C.2, NRG Connecticut shall by the close of each calendar day record the actual 24-hour average NOx emission rate, the actual fuel type and the actual quantity of each type of fuel in units of volume per day or MMBtu per day for each fuel used on the preceding day.
 - c. Middletown Power shall keep records of monthly and consecutive 12 month fuel consumption for Middletown 10. The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. Middletown Power shall make these calculations within 30 days of the end of the previous month.
 - d. Devon Power shall keep records of monthly and consecutive 12 month fuel consumption for Devon 10. The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. Devon Power shall make these calculations within 30 days of the end of the previous month.
 - e. NRG Connecticut shall provide the records required by this order to the Commissioner within thirty (30) days of receipt of a written request from the Commissioner.

- f. No later than March 1 of every year, NRG Connecticut shall submit to the Commissioner a written report containing copies of all records required by this Paragraph.
11. NRG Connecticut shall retain records, reports and supporting documentation required by this order for a minimum of five (5) years, commencing on the date such record or report was created.
 12. Retirement of DERs. On or before sixty (60) days after issuance of this order, NRG Connecticut shall deduct a minimum of 250 DERs from the current balance of DERs possessed.
 13. NRG Connecticut shall retire prior to use all DERs generated on and after January 1, 2020 by Middletown Unit 4, Montville Unit 5 or Montville Unit 6 pursuant to TAO #8365 and shall deduct such DERs from any calculations of DERs available and possessed by NRG Connecticut in lieu of retiring ten (10) percent of all DERs generated by Middletown Unit 4, Montville Unit 5 or Montville Unit 6 as required by Paragraph B.11 of TAO #8365.
 14. Expiration of this Order. This case-by-case NOx RACT determination expires on May 1, 2028, at which time NRG Connecticut shall operate the subject emissions units in compliance with the applicable emissions limits and other requirements of RCSA Section 22a-174-22e or cease operation.
 15. Approvals. NRG Connecticut shall use best efforts to submit to the Commissioner all documents required by this Consent Order in a complete and approvable form. If the Commissioner notifies NRG Connecticut that any document or other action is deficient, and does not approve it with conditions or modifications, it is deemed disapproved, and NRG Connecticut shall correct the deficiencies and resubmit it within the time specified by the Commissioner or, if no time is specified by the Commissioner, within 30 days of the Commissioner's notice of deficiencies. In approving any document or other action under this Consent Order, the Commissioner may approve the document or other action as submitted or performed or with such conditions or modifications as the Commissioner deems necessary to carry out the purposes of this Consent Order. Nothing in this paragraph shall excuse noncompliance or delay.
 16. Definitions. As used in this Consent Order, "Commissioner" means the Commissioner or a representative of the Commissioner.
 17. Dates. The date of "issuance" of this Consent Order is the date the Consent Order is deposited in the U.S. Mail or personally delivered, whichever is earlier. The date of submission to the Commissioner of any document required by this Consent Order shall be the date such document is received by the Commissioner. The date of any notice by the Commissioner under this Consent Order, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is deposited in the U.S. mail or is personally delivered, whichever is earlier. Except as otherwise specified in this Consent Order, the word "day" as used in this Consent Order means calendar day. Any document or action which is required by this Consent Order to be submitted or performed by

a date which falls on a Saturday, Sunday or a Connecticut or federal holiday shall be submitted or performed by the next day which is not a Saturday, Sunday or Connecticut or federal holiday.

18. Certification of documents. Any document, including but not limited to any notice, which is required to be submitted to the Commissioner under this Consent Order shall be signed by an individual employed by Middletown Power LLC, Montville Power LLC, Connecticut Jet Power LLC or Devon Power LLC, as applicable, who satisfies the criteria set forth in §22a-174-2a(a) of the Regulations of Connecticut State Agencies and by the individual(s) responsible for actually preparing such document. Each individual who signs documents in accordance with this paragraph shall certify in writing as follows:

“I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, that the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under Section 53a-157b of the Connecticut General Statutes and any other applicable law.”
19. Noncompliance. This Consent Order is a final order of the Commissioner with respect to the matters addressed herein, and is non-appealable and immediately enforceable. Failure to comply with this Consent Order may subject Middletown Power LLC, Montville Power LLC, Connecticut Jet Power LLC or Devon Power LLC to an injunction and penalties.
20. False statements. Any false statement in any information submitted pursuant to this Consent Order may be punishable as a criminal offense under Section 53a-157b of the Connecticut General Statutes and any other applicable law.
21. Notice of transfer; liability of Respondent. Until NRG Connecticut has fully complied with this Consent Order, NRG Connecticut shall notify the Commissioner in writing no later than 15 days after transferring all or any portion of the facility, the operations, the site or the business which is the subject of this Consent Order or after obtaining a new mailing or location address. NRG Connecticut's obligations under this Consent Order shall not be affected by the passage of title to any property to any other person or municipality.
22. Commissioner's powers. Nothing in this Consent Order shall affect the Commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for past, present, or future violations of law. If at any time the Commissioner determines that the actions taken by NRG Connecticut pursuant to this Consent Order have not successfully corrected all violations, fully characterized the extent or degree of any pollution, or successfully abated or prevented pollution, the Commissioner may institute any proceeding to require NRG Connecticut to undertake further investigation or further action to prevent or abate violations or pollution.

23. Respondent's obligations under law. Nothing in this Consent Order shall relieve Respondent of other obligations under applicable federal, state and local law.
24. No assurance by Commissioner. No provision of this Consent Order and no action or inaction by the Commissioner shall be construed to constitute an assurance by the Commissioner that the actions taken by NRG Connecticut pursuant to this Consent Order will result in compliance or prevent or abate pollution.
25. Access to site. Any representative of the Department of Energy and Environmental Protection may enter the facility without prior notice for the purposes of monitoring and enforcing the actions required or allowed by this Consent Order.
26. No effect on rights of other persons. This Consent Order neither creates nor affects any rights of persons or municipalities that are not parties to this Consent Order.
27. Notice to Commissioner of changes. Within 15 days of the date NRG Connecticut becomes aware of a change in any information submitted to the Commissioner under this Consent Order, or that any such information was inaccurate or misleading or that any relevant information was omitted, NRG Connecticut shall submit the correct or omitted information to the Commissioner.
28. Notification of noncompliance. In the event that NRG Connecticut becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this Consent Order or of any document required hereunder, NRG Connecticut shall promptly notify by telephone the Bureau of Air Management Unit in the next paragraph and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. Within five (5) days of the initial notice, NRG Connecticut shall submit in writing the date, time, and duration of the noncompliance and the reasons for the noncompliance or delay and propose for the review and written approval of the Commissioner, dates by which compliance will be achieved, and NRG Connecticut shall comply with any dates which may be approved in writing by the Commissioner. Notification by NRG Connecticut shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay.
29. Submission of documents. Any document required to be submitted to the Commissioner under this Consent Order, unless otherwise specified in this Consent Order or in writing by the Commissioner, shall be directed to:

Supervisor, Compliance Analysis and Coordination Unit
Enforcement Division
Bureau of Air Management
Department of Environmental Protection
79 Elm Street, 5th Floor
Hartford, Connecticut 06106-5127

NRG Connecticut consents to the issuance of this Consent Order without further notice. The undersigned certifies that he/she is fully authorized to enter into this Consent Order and to legally bind NRG Connecticut to the terms and conditions of the Consent Order.

MIDDLETOWN POWER LLC
MONTVILLE POWER LLC
CONNECTICUT JET POWER LLC
DEVON POWER LLC


Signature: 

Type Name: Judith Lagano

Type Title: President

Date: FEBRUARY 27, 2020

Issued as an order of the Commissioner of Energy and Environmental Protection.


Katherine S. Dykes
Commissioner
Department of Energy and Environmental Protection

3-10-2020
Date

MAILED CERTIFIED MAIL

ATTACHMENT NRG-2

Technical Support Document for Consent Order No.8377

Case-by-Case NO_x RACT Technical Support Document Consent Order #8377 – NRG Connecticut

The Department of Energy and Environmental Protection issued Consent Order #8377 to Connecticut Jet Power LLC, Devon Power LLC, Middletown Power LLC, and Montville Power LLC (collectively referred to as NRG Connecticut) on March 10, 2020. Consent Order #8377 establishes Phase 2 case-by-case NO_x RACT emission limits for five distillate-fired 20 MW turbines (Devon 10, Middletown 10, Branford 10, Torrington Terminal 10, and Franklin Drive 10) and two diesel-fired 2.75 MW engines (Montville 10 and Montville 11) in accordance with Section 22a-174-22e(h) of the Regulations of Connecticut State Agencies (RCSA). NRG Connecticut demonstrated that installing and operating NO_x controls on the subject turbines and IC engines is not technically or economically feasible. To realize a net air-quality benefit, Consent Order #8377 requires NRG Connecticut to install NO_x controls on Middletown Unit 4, Montville Unit 5 and Montville Unit 6 and over-control those boilers during the Phase 1 compliance period and to retire 250 banked Discrete Emission Reduction Credits (DERCs).

Case-by-Case NO_x RACT Demonstration

RCSA Section 22a-174-22e was adopted on December 22, 2016 and limits NO_x emissions from fuel-burning equipment located at major sources of NO_x and for high-emitting equipment at non-major sources of NO_x. The emissions limits are implemented in two phases, with a more stringent second phase. As an alternative to compliance with the emissions limits, the regulation includes compliance options (RCSA Section 22a-174-22e(g)) and the ability to apply for an alternative emission limit through a case-by-case NO_x RACT determination if NO_x controls are not technically or economically feasible for an emissions unit (RCSA Section 22a-174-22e(h)).

In accordance with RCSA Section 22a-174-22e(h)(1)(A), an application for a NO_x RACT determination must demonstrate that the use of available emissions control technology and each compliance option designated in RCSA Section 22a-174-22e(g) are either technically or economically infeasible for the subject emissions unit. Economic feasibility is defined to be equal to or less than \$13,635/ton of NO_x reduced for a Phase 2 demonstration. RCSA Section 22a-174-22e(h)(1)(B) requires the owner/operator to recommend a case-by-case RACT emissions limit for the emissions unit and allows the owner/operator to recommend additional actions to reduce NO_x emissions from stationary or mobile sources in Connecticut. RCSA Section 22a-174-22e(h)(1)(C) requires that a case-by-case NO_x RACT determination provide a net air quality benefit including real and quantifiable NO_x emissions reductions from any facility in Connecticut under control of the owner or operator submitting the demonstration. To demonstrate an air quality benefit the owner/operator is required to calculate the NO_x emissions reductions achievable by implementing the recommended emissions limits and additional actions and compare those emissions reductions to the NO_x emissions reductions that would have occurred if the emissions units complied with the emissions limits specified in RCSA Section 22a-174-22e(d).

On March 20, 2019, NRG Connecticut submitted a compliance plan including applications requesting the commissioner's approval of a Phase 2 case-by-case NO_x RACT emissions limit for Devon 10, Middletown 10, Branford 10, Torrington Terminal 10, Franklin Drive 10, Montville 10 and Montville 11. NRG Connecticut also requested limits on the allowable hours of operation for Middletown 10 and Devon 10. To achieve a net air quality benefit, NRG Connecticut proposed to

install air pollution control equipment on the three boilers (Middletown Unit 4, Montville Unit 5 and Montville Unit 6) and over-control those units during the Phase 1 compliance period.

Source Description

NRG Connecticut owns and operates electric generation facilities throughout Connecticut supplying wholesale power to the ISO New England electric power grid. Consent Order #8377 establishes Phase 2 case-by-case NOx RACT under RCSA Section 22a-174-22e(h) for the five kerosene (jet fuel)-fired, 20 MW turbines and the two diesel-fired, 2.75 MW internal combustion (IC) engines described in Table 1. NRG Connecticut is currently complying with the Phase 1 emissions limits for the units described in Table 1 through compliance with Trading Agreement and Order (TAO) #8366A issued on September 27, 2018 under RCSA Section 22a-174-22e(g).

Table 1 - Case-by-Case NOx RACT Demonstration Emissions Units Description

Unit ID/Location	Unit Description	Nominal Capacity (WM)	Unit Permit/Registration Number	Facility Permit/Registration Number
Devon 10 734 Naugatuck Ave Milford	P&W FT4A-8 Simple Cycle Turbine	20	P #105-0026	105-0063-TV
Middletown 10 1866 River Road Middletown	P&W FT4A-8 Simple Cycle Turbine	20	R #104-0102	104-0106-TV
Branford 10 Boston Post Road Branford	P&W FT4A-8 Simple Cycle Turbine	20	R #014-0008	014-0023-GPLPE
Franklin Drive 10 99 Franklin Drive Torrington	P&W FT4A-8 Simple Cycle Turbine	20	R #183-0049	183-0049-GPLPE
Torrington Terminal 10 1250 South Main Street Torrington	P&W FT4A-8 Simple Cycle Turbine	20	R #183-0059	183-0050-GPLPE
Montville 10 74 Lathrop Road Uncasville	2.75 MW IC Engine	2.75	R #107-0021	107-0043-TV
Montville 11 74 Lathrop Road Uncasville	2.75 MW IC Engine	2.75	R #107-0022	107-0043-TV

The Department issued Connecticut Jet Power registrations to operate the Branford and the two Torrington facilities under the General Permit to Limit Potential to Emit (GPLPE) issued in 2015. The GPLPE registrations limit source emissions to less than 50% of the Title V source emission levels (i.e. premises emissions are limited to less than 25 tons/year). Devon 10, Middletown 10, Montville 10 and Montville 11 are located at Title V facilities. Permit #105-0026 limits the fuel consumption for Devon 10 to no more 1.06 million gallons over any consecutive 12 month period

and limits NOx emissions to no more than 0.74 pounds/MMBtu and 53.7 tons/year. Montville 10 and Montville 11 are subject to collateral conditions contained in Permit #107-0012 that limit the total combined annual fuel use for both engines to no more than 80,000 gallons, the combined annual NOx emissions to no more than 15.138 tons and the NOx emission rate for each engine to 2.61 pounds/MMBtu. The IC engines are each equipped with a catalytic oxidizer. All of the turbines and engines are fast-start peaking units that are typically dispatched in response to very high electric demand or abnormal conditions where grid reliability is at risk. Operating records indicate that these units run infrequently, generally for fewer than 30 hours per year (see Table 2).

Table 2 – Five-Year Operating History

	Annual Hours of Operation					
	2018	2017	2016	2015	2014	2014-2018 Average
Middletown 10	20	22	23	21	13	20
Devon 10	9	17	16	10	12	13
Branford 10	16	26	33	9	6	18
Franklin Drive 10	19	22	14	23	11	18
Torrington Terminal 10	18	28	7	14	15	16
Montville 10	27	4	6	6	82	25
Montville 11	29	4	6	5	78	24

Because of the limited operating time, these units have relatively low annual emissions even though the NOx emissions rates for the units are relatively high. The five-year average historical emissions are summarized in Table 3. More detailed emissions information is provided in Attachment 1. The calculations are based on reported annual and ozone-season fuel consumption and the NOx emissions rates were determined by stack test results.

Table 3 - 2014-2018 Average Annual and O₃-Season NOx Emissions

	NOx Emissions Rate (lb/MMBtu)	Annual NOx Emissions (tons)	O ₃ -Season NOx Emissions (tons)
Devon 10	0.712	1.16	0.52
Middletown 10	0.647	1.55	1.01
Branford 10	0.678	1.57	1.05
Franklin Drive 10	0.659	1.49	0.68
Torrington Terminal 10	0.721	1.52	0.95
Montville 10	2.51	0.91	0.14
Montville 11	2.41	0.85	0.14

Consent Order #8377 requires NRG Connecticut to install air pollution control equipment on the boilers described in Table 4 and over-control those units during the Phase 1 compliance period. Middletown Unit 4 is a tangentially fired, Combustion Engineering boiler rated at 4,684

MMBtu/hour and capable of producing 400 MW. Unit 4 is capable of burning No. 6 oil; No. 2 oil is used for ignition only. Montville Unit 5 is rated at 995 million Btu/hour and is capable of producing 82 MW. Unit 5 can burn No. 6 oil and natural gas, on an interruptible basis; No. 2 oil is used for startup, shutdown and operational stabilization. Unit 5 is equipped with an electrostatic precipitator for particulate emission control and NOx emissions are controlled by using excess air in the combustion process. Montville Unit 6 is rated at 4,658 million Btu/hour and is capable of producing 402 MW. Unit 6 burns No. 6 oil as the primary fuel; No. 2 oil is used for startup, shutdown and operational stabilization. NOx emissions are controlled by using excess air in the combustion process. Each boiler is equipped with CEM for NOx, CO₂, SO₂ and opacity.

Table 4 – Boilers Proposed for Over-Control During Phase 1

Unit ID/Location	Unit Description	Unit Permit/ Registration Number	Title V Permit Number
Middletown Unit 4 1866 River Road, Middletown	400 MW Utility Boiler	P #104-0003	104-0106-TV
Montville Unit 5 74 Lathrop Road, Uncasville	82 MW Utility Boiler	R #107-0017	107-0043-TV
Montville Unit 6 74 Lathrop Road, Uncasville	402 MW Utility Boiler	R #107-0020	107-0043-TV

NOx RACT Determination: Evaluation of NOx Emissions Controls

The NOx control technologies available for distillate-fired combustion turbines are high pressure water injection (HPWI) and selective catalytic reduction (SCR). The NOx control technology available for diesel-fired IC engines is SCR. The RCSA Section 22a-174-22e(g) compliance options available for simple cycle turbines and IC engines are to reduce the average emission rate by at least 40% from a 2019 baseline or retire another unit or units located at the same facility. In addition, the installation and operation of water injection technology is available as a compliance option for simple cycle turbines.

NRG Connecticut determined that HPWI and SCR are technologies capable of lowering the emissions rate of a P&W FT4A-8 turbine by at least 40% and SCR is capable of lowering the emissions rate of an IC engine by at least 40%. No units were identified that could be retired at the premises where the units are located. NRG Connecticut determined that installation of HPWI is technically feasible for all of the subject turbines. SCR is technically feasible for Devon 10 and the IC engines (Montville 10 and 11). SCR is not technically feasible for the remaining turbines due to lateral and vertical space constraints. Branford 10, Franklin Drive 10 and Torrington Terminal 10 are located at Eversource substations. An underground high-pressure natural gas pipeline is located adjacent to Middletown 10 and there are overhead transmission lines.

Table 5 compares the emissions rates achievable with the technically feasible control technologies with the uncontrolled emissions rates and the Phase 2 emissions limits specified in RCSA Section 22a-174-22e(d)(4)(C) for the turbines and RCSA Section 22a-174-22e(d)(6)(B) for the IC engines.

Because the turbines are, by definition, “affected units” (i.e. fossil fuel-fired stationary source that serves a generator with a nameplate capacity of 15 MW or more), the turbines are also subject to the seven-month average non-ozone season emissions limit (0.15 pound/MMBtu) specified in RCSA Section 22a-174-22e(d)(4)(D). Compliance with this limit, however, cannot be demonstrated with NOx emissions testing conducted pursuant to RCSA Section 22a-174-22e(l) which consists of three one-hour tests conducted at 90% or more of the maximum rated capacity. As can be seen for the data in Table 5, the turbines cannot meet the emissions limit with HPWI.

Unit ID	Uncontrolled Emissions Rate (lb/MMBtu)	Control Technology	Controlled Emissions Rate (lb/MMBtu)	Sec 22e(d) Emissions Limit (lb/ MMBtu)
Devon 10	0.712	SCR	0.18	0.19
		HPWI	0.285	
Middletown 10	0.647	HPWI	0.259	0.19
Branford 10	0.678	HPWI	0.271	0.19
Franklin Drive 10	0.659	HPWI	0.264	0.19
Torrington Terminal 10	0.721	HPWI	0.288	0.19
Montville 10	2.51	SCR	0.5	0.5
Montville 11	2.41	SCR	0.5	0.5

NRG Energy evaluated dry low-NOx combustors (DLNC) for the turbines as part of a study of NOx control technologies required by TAO #8300 submitted in April 2011. NRG Energy eliminated the technology from further evaluation because the DLNC retrofits were unreliable and the retrofit package was no longer available. NRG Connecticut did not include DLNC in the case-by-case reasonably available control technology (RACT) demonstration because the technology was primarily designed for gas-fired units and attempts to adapt the technology for liquid fuel-fired units was unsuccessful. As a result, further development was abandoned.

NRG Connecticut calculated the NOx reduction efficiency, annualized cost and cost effectiveness for each of the technically feasible control technologies. The annualized cost and cost effectiveness were calculated using the *Air Pollution Control Cost Effectiveness Assessment Template* developed by the Department to support a request for a case-by-case RACT determination by providing an acceptable method for calculating the cost effectiveness of SCR, selective non-catalytic reduction (SNCR) and HPWI retrofits. Table 8-4 of EPA’s financial assumption guidance¹ specifies a 15 year book life for retrofits. NRG Connecticut used this number in the cost calculations for all subject unit. NRG Connecticut used the requested allowable

¹ Environmental Protection Agency. *Power Sector Modeling Platform v.5.13, Chapter 8 Financial Assumptions*. https://www.epa.gov/sites/production/files/2015-08/documents/chapter_8_financial_assumptions.pdf

hours of operation limits to calculate the cost effectiveness for Middletown 10 (500 hours/year) and Devon 10 (465 hours/year). Subdivisions (D) and (E) of RCSA Section 22a-174-22e(h)(6) allows the cost calculations to be made based on the requested limit on potential emissions. The default retrofit factor of 1 was used in calculating the costs for Middletown 10 and Devon 10 as these turbines are located at NRG-owned sites.

NRG Connecticut calculated the annualized cost and cost effectiveness for the GPLPE units (Branford 10, Franklin Drive 10 and Torrington Terminal 10) using 580 hours/year operating limit. The 580 hours/year operating limit is an estimate of number of hours the turbines could run at full capacity with emissions remaining under the Title V source emission levels (i.e. less than 50 tons/year). However, these units are registered under the GPLPE 50 and potential emissions are limited to 25 tons/year. NRG Connecticut used a retrofit factor of 1.5 in their calculations for the GPLPE turbines because of the added expense associated with working at the Eversource substations in proximity to high-voltage equipment. Therefore, values calculated are conservative estimates of the actual cost effectiveness.

NRG Connecticut used the default retrofit factor in calculating the costs for Montville 10 and Montville 11 as they are located at NRG-owned site. The collateral condition on Montville 10 and Montville 11 contained in Permit #107-0012 limiting total combined fuel use for both engines to no more than 80,000 gallons/year corresponds to a limit of approximately 372 hours/year of combined runtime. NRG Connecticut calculated the annualized cost and cost effectiveness using 372 hours/year for each engine (i.e. as if each engine was limited to 372 hours/year, not both) resulting in a conservative estimates of the control costs. The estimated NOx reduction efficiency and the results of the cost calculations are summarized in Table 6 for each of the technically feasible control technologies.

Table 6 - Control and Cost Effectiveness of Technically Feasible Control Technologies

Emissions Unit	Control Technology	Control Effectiveness (%)	Annualized Cost (\$/year)	Cost Effectiveness (\$/ton)
Devon 10	SCR	74.7	\$674,292	\$22,321
	HPWI	60	\$332,304	\$13,699
Middletown 10	HPWI	60	\$334,791	\$14,704
Branford 10	HPWI	60	\$451,252	\$16,237
Franklin Drive 10	HPWI	60	\$468,158	\$15,165
Torrington Terminal 10	HPWI	60	\$460,278	\$14,917
Montville 10	SCR	80.1	\$180,395	\$17,297
Montville 11	SCR	79.3	\$180,151	\$18,178

The cost effectiveness calculated for all of the technically feasible control technologies available for the subject units are greater than the economic feasibility threshold of \$13,635/ton of NOx

reduced for a Phase 2 demonstration. Based on these results, NRG Connecticut has demonstrated that the technically feasible control technologies available for the subject emissions units are not economically feasible.

Public Participation

According to RCSA Section 22a-174-22e(h)(9)(A), prior to submitting a case-by-case application, an owner/operator is required to publish a notice informing the public of the request for a case-by-case RACT determination in a newspaper of general circulation in the area in which the emissions unit operates and holding a public informational hearing to explain the purpose of and basis for the request if any request for such hearing is made. RCSA Section 22a-174-22e(h)(9)(B) requires the owner/operator to notify the chief elected official of the municipality in which the subject emissions unit is located.

NRG Connecticut certified that notices were published in the newspapers identified in Table 7 on the dates indicated and a notification letter was sent to the chief elected official of each of the respective municipalities. For each municipality, a copy of the notice, a notarized certificate of publication and a copy of the letter sent to the chief elected official was submitted with the case-by-case application. Because NRG Connecticut received no requests for a hearing, no hearings were held. It appears that NRG Connecticut has satisfied all public participation requirements specified in Subdivisions (9) through (12) of RCSA Section 22a-174-22e(h).

Table 7 - Public Notification

Municipality	Publication	Date Published	Chief Elected Official	Date of Letter
Devon	Milford Mirror	12/20/2018	Mayor Blake	12/14/2018
Middletown	Middletown Press	12/14/2018	Mayor Drew	12/14/2018
Branford	New Haven Register	12/14/2018	First Selectman Cosgrove	12/14/2018
Torrington	Register Citizen	12/14/2018	Mayor Carbone	12/14/2018
Montville	The Day	12/14/2018	Mayor McDaniel	12/14/2018

Phase 2 NOx RACT Determination.

NRG Connecticut demonstrated that no NOx control technologies that are technically and economically feasible are available for the subject emissions units. The recommended case-by-case NOx emissions limits for the subject units are listed in Table 8. For the turbines the recommended emissions limits are equal to the full-load emissions rates (FLERs) specified in TAO #8366A. For Devon 10 the recommended emissions limit is also equal to the NOx emissions rate limit specified in Permit #105-0026. For the internal combustion (IC) engines the recommended emissions limits are equal to the emissions rate limit specified in Permit #107-0012. Consent Order #8377 prohibits NRG Connecticut from exceeding these limits on and after June 1, 2023 and requires NRG Connecticut to demonstrate compliance with the NOx emissions limits through emissions testing performed in accordance with RSCA Section 22a-174-22e(l). In addition, the order limits Middletown Power to combusting no more than 850,000 gallons of fuel during any

consecutive 12 month period in Middletown 10 and limits Devon Power to combusting no more than 874,000 gallons of fuel during any consecutive 12 month period in Devon 10.

Table 8 – Phase 2 NOx RACT Determination

Unit ID	NOx Emissions Limit (pound/MMBtu)
Devon 10	0.74
Middletown 10	0.67
Branford 10	0.8
Franklin Drive 10	0.8
Torrington Terminal 10	0.8
Montville 10	2.61
Montville 11	2.61

Air Quality Benefit

RCSA Section 22a-174-22e(h)(1)(C) requires that a case-by-case RACT demonstration provide a net air quality benefit including real and quantifiable reductions in NOx emissions from any facility in Connecticut under control of the owner/operator submitting the demonstration. The owner/operator must calculate the NOx emissions reductions achievable by implementing the recommended emissions limits and additional actions and compare that emissions reductions to the NOx emissions reductions that would have occurred if the emissions units complied with the emissions limits specified in RCSA Section 22a-174-22e(d). RCSA Section 22a-174-22e(h)(8) does not allow the reduction in potential emissions of NOx associated with the imposition of a limit on fuel use, raw materials processed or hours of operation to be included as a net air quality benefit.

Potential and estimated actual emissions calculations were made to quantify the net air quality benefit of the proposal. Annual uncontrolled and controlled emissions for the boilers were calculated and compared to determine the annual emissions reductions of controls on the boilers. Annual uncontrolled emissions for the turbines and IC engines and the annual emissions that would have occurred if the turbines and IC engines complied with the emissions limits specified in RCSA Section 22a-174-22e(d) were calculated and compared to determine the annual excess emissions resulting from the proposed NOx RACT determination for the subject emissions units. As required by RCSA Section 22a-174-22e(h)(8), the limits on hours of operation were not used in the potential emissions calculations for Devon 10 and Middletown 10. The “actual” annual NOx emissions calculations assumed that the dispatch profiles of emissions units would remain similar to those experienced during 2014 through 2018 and emissions calculations are based on the 2014 through 2018 average fuel use/heat input for each unit. These calculations are provided in Attachment 2.

The annual emissions benefit of controls were used to calculate the total benefit of controls in the Phase 1 compliance period. The annual excess emissions resulting from the NOx RACT determination were used to calculate the total excess emissions in the Phase 2 compliance period. As can be seen from the results summarized in Table 9 and Table 10, the compliance plan provides

a potential net air quality benefit of 1,152 tons of NO_x and an estimated actual net air quality benefit of 4.0 tons NO_x.

Table 9 - Potential Net Air Quality Impacts (tons NO_x)

	Potential Benefit of Controls			Potential Excess Emissions for Turbines and IC Engines
	MD Unit 4	MV Unit 5	MV Unit 6	
2020	410	100		
2021	615	100	816	
2022	615	100	816	
2023	256	42	340	363
2024				622
2025				622
2026				622
2027				622
2028				207
Totals	1,896	342	1,972	3058
	4,210			

Potential Net Air Quality Benefit = 1,152 tons NO_x

Table 10 – Estimated Actual Net Air Quality Impacts (tons NO_x)

	Estimated Actual Benefit of Controls			Estimated Actual Excess Emissions for Turbines and IC Engines
	MD Unit 4	MV Unit 5	MV Unit 6	
2020	3.5	1.0		
2021	5.3	1.0	7.0	
2022	5.3	1.0	7.0	
2023	2.2	0.4	2.9	3.9
2024				6.64
2025				6.64
2026				6.64
2027				6.64
2028				2.2
Totals	16.3	3.4	16.9	32.6
	36.6			

Average “Actual” Net Air Quality Benefit = 4.0 tons NO_x

Discrete Emissions Reduction Credits (DERCs)

TAO #8365 authorizes NRG Connecticut to use and generate DERCs for Middletown Unit 2, Middletown Unit 3, Middletown Unit 4, Montville Unit 5 and Montville Unit 6. Paragraph B.11 of TAO #8365 requires that ten percent of any DERCs generated are retired prior to use to provide an environmental benefit. The number of DERCs used for the operation of Middletown Unit 4, Montville Unit 5 and Montville Unit 6 are listed in Table 11. During 2014 through 2018 Middletown Unit 4 generated 9 DERCs and Montville Units 5 and 6 generated 24 DERCs.

Table 11 - 2104 – 2018 DERC Use - Boilers

	Middletown Unit 4	Montville Unit 5	Montville Unit 6	Total
2014	30	0	7	37
2015	1	0	22	23
2016	0	0	0	0
2017	0	0	4	4
2018	53	7	21	81
Total:	84	7	54	145

To ensure that the emissions reduction benefits of early control are not lost to DERC trading, Consent Order #8377 requires NRG Connecticut to retire 250 banked DERCs within 60 days after the issuance of the order. In addition, the proposed order requires NRG to retire any DERCs generated by Middletown Unit 4, Montville Unit 5, or Montville Unit 6 on and after January 1, 2020. This retirement of DERCs is in lieu of the ten percent of DERCs required to be retired by Paragraph B.11 of TAO #8365.

The order expires on May 1, 2028, at which time NRG Connecticut will be required to operate the subject emissions units in compliance with the applicable emissions limits and other requirements of RCSA Section 22a-174-22e or cease operation.

**Attachment 1
2014 – 2018 Emissions**

Devon 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	17,032	2,299	0.82	10,084	1,361	0.48	6,948	938	0.33
2017	32,851	4,435	1.58	22,058	2,978	1.06	10,793	1,457	0.52
2016	29,487	3,981	1.42	11,683	1,577	0.56	17,804	2,404	0.86
2015	18,147	2,450	0.87	10,536	1,422	0.51	7,611	1,027	0.37
2014	22,780	3,075	1.09	-	-	-	22,780	3,075	1.09
2014 - 2018 Average	24,059	3,248	1.16	10,872	1,468	0.52	3,187	1,780	0.63

NOx Emissions rate = 0.712 lb/MMBtu

Middletown 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	35,896	4,846	1.57	24,626	3,325	1.08	11,270	1,521	0.49
2017	39,107	5,279	1.71	21,578	2,913	0.94	17,529	2,366	0.77
2016	41,277	5,572	1.80	32,423	4,377	1.42	8,854	1,195	0.39
2015	37,372	5,045	1.63	36,731	4,959	1.60	641	87	0.03
2014	23,695	3,199	1.03	-	-	0.00	23,695	3,199	1.03
2014 - 2018 Average	35,469	4,788	1.55	23,072	3,115	1.01	12,398	1,674	0.54

NOx Emissions rate = 0.647 lb/MMBtu

Branford 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	30,115	4,066	1.38	13,768	1,859	0.63	16,347	2,207	0.75
2017	50,061	6,758	2.29	35,044	4,731	1.60	15,017	2,027	0.69
2016	62,011	8,371	2.84	54,410	7,345	2.49	7,601	1,026	0.35
2015	17,351	2,342	0.79	11,692	1,578	0.54	5,659	764	0.26
2014	11,742	1,585	0.54	-	-	0.00	11,742	1,585	0.54
2014 - 2018 Average	34,256	4,625	1.57	22,983	3,103	1.05	11,273	1,522	0.52

Emissions rate = 0.78 lb/MMBtu

Franklin Drive 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	35,682	4,817	1.59	18,058	2,438	0.80	17,624	2,379	0.78
2017	41,064	5,544	1.83	28,595	3,860	1.27	12,469	1,683	0.55
2016	25,696	3,469	1.14	17,330	2,340	0.77	8,366	1,129	0.37
2015	42,883	5,789	1.91	12,245	1,653	0.54	30,638	4,136	1.36
2014	21,652	2,923	0.96	-	-	-	21,652	2,923	0.96
2014 - 2018 Average	33,395	4,508	1.49	15,246	2,058	0.68	18,150	2,450	0.81

Emissions rate = 0.659 lb/MMBtu

Torrington Terminal 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	33,828	4,567	1.65	11,464	1,548	0.56	22,364	3,019	1.09
2017	53,773	7,259	2.62	39,436	5,324	1.92	14,337	1,935	0.70
2016	13,516	1,825	0.66	5,552	750	0.27	7,964	1,075	0.39
2015	27,011	3,646	1.31	17,059	2,303	0.83	9,952	1,344	0.48
2014	27,654	3,733	1.35	24,239	3,272	1.18	3,415	461	0.17
2014 - 2018 Average	31,156	4,206	1.52	19,550	2,639	0.95	11,606	1,567	0.56

Emissions rate = 0.721 lb/MMBtu

Montville 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	5,847	789	0.99	2,393	323	0.41	3,454	466	0.59
2017	806	109	0.14	-	-	0	806	109	0.14
2016	1,208	163	0.20	740	100	0.13	468	63	0.08
2015	1,244	168	0.21	671	91	0.11	573	77	0.10
2014	17,683	2,387	3.00	421	57	0.07	17,262	2,330	2.92
2014 - 2018 Average	5,358	723	0.91	845	114	0.14	4,513	609	0.76

Emissions rate = 2.51 lb/MMBtu

Montville 11

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	6,207	838	1.01	2,393	323	0.39	3,814	515	0.62
2017	808	109	0.13	-	-	0	808	109	0.13
2016	1,208	163	0.20	740	100	0.12	468	63	0.08
2015	1,157	156	0.19	671	91	0.11	486	66	0.08
2014	16,748	2,261	2.72	421	57	0.07	16,327	2,204	2.66
2014 - 2018 Average	5,226	705.46	0.85	845	114	0.14	4,381	591	0.71

Emissions rate = 2.41 lb/MMBtu

Assumed Gross Heat Value of Fuel = 0.135 MMBtu/gal

**Attachment 2
Annual Emissions Calculations**

Potential Emissions Calculations:

(Potential Emissions = Maximum Capacity x Potential Hours of Operation x Emissions Rate / 2000 pounds/ton)

Unit ID	Maximum Rated Capacity (MMBtu/hr)	Uncontrolled Emissions Rate (#/MMBtu)	Controlled Emissions Rate (#/MMBtu)	Potential Emissions (tons/year)		
				Uncontrolled	Controlled	Emissions Benefit of Controls
Middletown Unit 4	4,684	0.23	0.2	4,719	4,103	615
Montville Unit 5	995	0.173	0.15	754	654	100
Montville Unit 6	4,658	0.23	0.19	4,692	3,876	816

No enforceable limit on hours of operation of boilers, 8760 hours/year used in calculations

Unit ID	Maximum Capacity (MMBtu/hr)	Operating Limit (hr/year)	Proposed Emissions Limit (lb/MMBtu)	Sec 22e(d) Emissions Limit (#/ MMBtu)	Potential Emissions (tons/year)		
					Uncontrolled	section 22e(d)	Theoretical Benefit of section 22e(d) Limits
Devon 10	254	563	0.74	0.19	53.7	13.6	40.1
Middletown 10	244	8760	0.67	0.19	716	203	513
Branford 10	245	250	0.8	0.19	24.5	5.8	18.7
Franklin Drive 10	256	250	0.8	0.19	25.6	6.1	19.5
Torrington Terminal 10	256	250	0.8	0.19	25.6	6.1	19.5
Montville 10	29	372	2.61	0.5	14.1	2.7	11.4
Montville 11	29		2.61	0.5			
Totals:					859.5	237.3	622

Combined PTE for both IC engines based on combined fuel-use limit in Permit #107-0012

Hours of operation for Branford 10, Franklin Drive 10 and Torrington Terminal 10 are limited by GPLPE emissions limit.

Hours of operation for Devon 10 limited by 1.06 MM-gallon/year fuel use limit in Permit #105-0026

Estimated Actual Emissions Calculations

(Estimated Actual Emissions = Average Historic Heat Input x Emissions Rate / 2000 pounds/ton)

Unit ID	2014-2018 Average Annual Heat Input (MMBtu/year)	Uncontrolled Emissions Rate (#/MMBtu)	Controlled Emissions Rate (#/MMBtu)	2014 - 2018 Estimated "Actual" Emissions (tons/year)		
				Uncontrolled	Controlled	Emissions Benefit of Controls
Middletown Unit 4	350,635	0.23	0.2	40.3	35.1	5.3
Montville Unit 5	82,831	0.173	0.15	7.2	6.2	1.0
Montville Unit 6	348,198	0.23	0.19	40.0	33.1	7.0

Unit ID	2014-2018 Average Annual Fuel Use (gal)	2014-2018 Average Annual Heat Input (MMBtu)	Uncontrolled Emissions Rate (#/MMBtu)	Sec 22e(d) Emissions Limit (#/ MMBtu)	2014 - 2018 Average "Actual" Emissions (tons/year)		
					Uncontrolled	sec 22e(d)	Theoretical Benefit of sec 22e(d) Limits
Devon 10	24,059	3,248	0.712	0.19	1.16	0.31	0.8
Middletown 10	35,469	4,788	0.647	0.19	1.55	0.45	1.1
Branford 10	34,256	4,625	0.678	0.19	1.57	0.44	1.1
Franklin Drive 10	33,395	4,508	0.659	0.19	1.49	0.43	1.1
Torrington Terminal 10	31,156	4,206	0.721	0.19	1.52	0.40	1.1
Montville 10	5,358	723	2.51	0.5	0.91	0.18	0.7
Montville 11	5,226	705	2.41	0.5	0.85	0.18	0.7
Totals:					9.03	2.39	6.64

Heat value of fuel oil = 0.135 MMBtu/gallon

Case-by-Case NO_x RACT Technical Support Document Consent Order #8377 – NRG Connecticut

The Department of Energy and Environmental Protection issued Consent Order #8377 to Connecticut Jet Power LLC, Devon Power LLC, Middletown Power LLC, and Montville Power LLC (collectively referred to as NRG Connecticut) on March 10, 2020. Consent Order #8377 establishes Phase 2 case-by-case NO_x RACT emission limits for five distillate-fired 20 MW turbines (Devon 10, Middletown 10, Branford 10, Torrington Terminal 10, and Franklin Drive 10) and two diesel-fired 2.75 MW engines (Montville 10 and Montville 11) in accordance with Section 22a-174-22e(h) of the Regulations of Connecticut State Agencies (RCSA). NRG Connecticut demonstrated that installing and operating NO_x controls on the subject turbines and IC engines is not technically or economically feasible. To realize a net air-quality benefit, Consent Order #8377 requires NRG Connecticut to install NO_x controls on Middletown Unit 4, Montville Unit 5 and Montville Unit 6 and over-control those boilers during the Phase 1 compliance period and to retire 250 banked Discrete Emission Reduction Credits (DERCs).

Case-by-Case NO_x RACT Demonstration

RCSA Section 22a-174-22e was adopted on December 22, 2016 and limits NO_x emissions from fuel-burning equipment located at major sources of NO_x and for high-emitting equipment at non-major sources of NO_x. The emissions limits are implemented in two phases, with a more stringent second phase. As an alternative to compliance with the emissions limits, the regulation includes compliance options (RCSA Section 22a-174-22e(g)) and the ability to apply for an alternative emission limit through a case-by-case NO_x RACT determination if NO_x controls are not technically or economically feasible for an emissions unit (RCSA Section 22a-174-22e(h)).

In accordance with RCSA Section 22a-174-22e(h)(1)(A), an application for a NO_x RACT determination must demonstrate that the use of available emissions control technology and each compliance option designated in RCSA Section 22a-174-22e(g) are either technically or economically infeasible for the subject emissions unit. Economic feasibility is defined to be equal to or less than \$13,635/ton of NO_x reduced for a Phase 2 demonstration. RCSA Section 22a-174-22e(h)(1)(B) requires the owner/operator to recommend a case-by-case RACT emissions limit for the emissions unit and allows the owner/operator to recommend additional actions to reduce NO_x emissions from stationary or mobile sources in Connecticut. RCSA Section 22a-174-22e(h)(1)(C) requires that a case-by-case NO_x RACT determination provide a net air quality benefit including real and quantifiable NO_x emissions reductions from any facility in Connecticut under control of the owner or operator submitting the demonstration. To demonstrate an air quality benefit the owner/operator is required to calculate the NO_x emissions reductions achievable by implementing the recommended emissions limits and additional actions and compare those emissions reductions to the NO_x emissions reductions that would have occurred if the emissions units complied with the emissions limits specified in RCSA Section 22a-174-22e(d).

On March 20, 2019, NRG Connecticut submitted a compliance plan including applications requesting the commissioner's approval of a Phase 2 case-by-case NO_x RACT emissions limit for Devon 10, Middletown 10, Branford 10, Torrington Terminal 10, Franklin Drive 10, Montville 10 and Montville 11. NRG Connecticut also requested limits on the allowable hours of operation for Middletown 10 and Devon 10. To achieve a net air quality benefit, NRG Connecticut proposed to

install air pollution control equipment on the three boilers (Middletown Unit 4, Montville Unit 5 and Montville Unit 6) and over-control those units during the Phase 1 compliance period.

Source Description

NRG Connecticut owns and operates electric generation facilities throughout Connecticut supplying wholesale power to the ISO New England electric power grid. Consent Order #8377 establishes Phase 2 case-by-case NO_x RACT under RCSA Section 22a-174-22e(h) for the five kerosene (jet fuel)-fired, 20 MW turbines and the two diesel-fired, 2.75 MW internal combustion (IC) engines described in Table 1. NRG Connecticut is currently complying with the Phase 1 emissions limits for the units described in Table 1 through compliance with Trading Agreement and Order (TAO) #8366A issued on September 27, 2018 under RCSA Section 22a-174-22e(g).

Table 1 - Case-by-Case NO_x RACT Demonstration Emissions Units Description

Unit ID/Location	Unit Description	Nominal Capacity (WM)	Unit Permit/Registration Number	Facility Permit/Registration Number
Devon 10 734 Naugatuck Ave Milford	P&W FT4A-8 Simple Cycle Turbine	20	P #105-0026	105-0063-TV
Middletown 10 1866 River Road Middletown	P&W FT4A-8 Simple Cycle Turbine	20	R #104-0102	104-0106-TV
Branford 10 Boston Post Road Branford	P&W FT4A-8 Simple Cycle Turbine	20	R #014-0008	014-0023-GPLPE
Franklin Drive 10 99 Franklin Drive Torrington	P&W FT4A-8 Simple Cycle Turbine	20	R #183-0049	183-0049-GPLPE
Torrington Terminal 10 1250 South Main Street Torrington	P&W FT4A-8 Simple Cycle Turbine	20	R #183-0059	183-0050-GPLPE
Montville 10 74 Lathrop Road Uncasville	2.75 MW IC Engine	2.75	R #107-0021	107-0043-TV
Montville 11 74 Lathrop Road Uncasville	2.75 MW IC Engine	2.75	R #107-0022	107-0043-TV

The Department issued Connecticut Jet Power registrations to operate the Branford and the two Torrington facilities under the General Permit to Limit Potential to Emit (GPLPE) issued in 2015. The GPLPE registrations limit source emissions to less than 50% of the Title V source emission levels (i.e. premises emissions are limited to less than 25 tons/year). Devon 10, Middletown 10, Montville 10 and Montville 11 are located at Title V facilities. Permit #105-0026 limits the fuel consumption for Devon 10 to no more 1.06 million gallons over any consecutive 12 month period

and limits NOx emissions to no more than 0.74 pounds/MMBtu and 53.7 tons/year. Montville 10 and Montville 11 are subject to collateral conditions contained in Permit #107-0012 that limit the total combined annual fuel use for both engines to no more than 80,000 gallons, the combined annual NOx emissions to no more than 15.138 tons and the NOx emission rate for each engine to 2.61 pounds/MMBtu. The IC engines are each equipped with a catalytic oxidizer. All of the turbines and engines are fast-start peaking units that are typically dispatched in response to very high electric demand or abnormal conditions where grid reliability is at risk. Operating records indicate that these units run infrequently, generally for fewer than 30 hours per year (see Table 2).

Table 2 – Five-Year Operating History

	Annual Hours of Operation					
	2018	2017	2016	2015	2014	2014-2018 Average
Middletown 10	20	22	23	21	13	20
Devon 10	9	17	16	10	12	13
Branford 10	16	26	33	9	6	18
Franklin Drive 10	19	22	14	23	11	18
Torrington Terminal 10	18	28	7	14	15	16
Montville 10	27	4	6	6	82	25
Montville 11	29	4	6	5	78	24

Because of the limited operating time, these units have relatively low annual emissions even though the NOx emissions rates for the units are relatively high. The five-year average historical emissions are summarized in Table 3. More detailed emissions information is provided in Attachment 1. The calculations are based on reported annual and ozone-season fuel consumption and the NOx emissions rates were determined by stack test results.

Table 3 - 2014-2018 Average Annual and O₃-Season NOx Emissions

	NOx Emissions Rate (lb/MMBtu)	Annual NOx Emissions (tons)	O ₃ -Season NOx Emissions (tons)
Devon 10	0.712	1.16	0.52
Middletown 10	0.647	1.55	1.01
Branford 10	0.678	1.57	1.05
Franklin Drive 10	0.659	1.49	0.68
Torrington Terminal 10	0.721	1.52	0.95
Montville 10	2.51	0.91	0.14
Montville 11	2.41	0.85	0.14

Consent Order #8377 requires NRG Connecticut to install air pollution control equipment on the boilers described in Table 4 and over-control those units during the Phase 1 compliance period. Middletown Unit 4 is a tangentially fired, Combustion Engineering boiler rated at 4,684

MMBtu/hour and capable of producing 400 MW. Unit 4 is capable of burning No. 6 oil; No. 2 oil is used for ignition only. Montville Unit 5 is rated at 995 million Btu/hour and is capable of producing 82 MW. Unit 5 can burn No. 6 oil and natural gas, on an interruptible basis; No. 2 oil is used for startup, shutdown and operational stabilization. Unit 5 is equipped with an electrostatic precipitator for particulate emission control and NOx emissions are controlled by using excess air in the combustion process. Montville Unit 6 is rated at 4,658 million Btu/hour and is capable of producing 402 MW. Unit 6 burns No. 6 oil as the primary fuel; No. 2 oil is used for startup, shutdown and operational stabilization. NOx emissions are controlled by using excess air in the combustion process. Each boiler is equipped with CEM for NOx, CO₂, SO₂ and opacity.

Table 4 – Boilers Proposed for Over-Control During Phase 1

Unit ID/Location	Unit Description	Unit Permit/ Registration Number	Title V Permit Number
Middletown Unit 4 1866 River Road, Middletown	400 MW Utility Boiler	P #104-0003	104-0106-TV
Montville Unit 5 74 Lathrop Road, Uncasville	82 MW Utility Boiler	R #107-0017	107-0043-TV
Montville Unit 6 74 Lathrop Road, Uncasville	402 MW Utility Boiler	R #107-0020	107-0043-TV

NOx RACT Determination: Evaluation of NOx Emissions Controls

The NOx control technologies available for distillate-fired combustion turbines are high pressure water injection (HPWI) and selective catalytic reduction (SCR). The NOx control technology available for diesel-fired IC engines is SCR. The RCSA Section 22a-174-22e(g) compliance options available for simple cycle turbines and IC engines are to reduce the average emission rate by at least 40% from a 2019 baseline or retire another unit or units located at the same facility. In addition, the installation and operation of water injection technology is available as a compliance option for simple cycle turbines.

NRG Connecticut determined that HPWI and SCR are technologies capable of lowering the emissions rate of a P&W FT4A-8 turbine by at least 40% and SCR is capable of lowering the emissions rate of an IC engine by at least 40%. No units were identified that could be retired at the premises where the units are located. NRG Connecticut determined that installation of HPWI is technically feasible for all of the subject turbines. SCR is technically feasible for Devon 10 and the IC engines (Montville 10 and 11). SCR is not technically feasible for the remaining turbines due to lateral and vertical space constraints. Branford 10, Franklin Drive 10 and Torrington Terminal 10 are located at Eversource substations. An underground high-pressure natural gas pipeline is located adjacent to Middletown 10 and there are overhead transmission lines.

Table 5 compares the emissions rates achievable with the technically feasible control technologies with the uncontrolled emissions rates and the Phase 2 emissions limits specified in RCSA Section 22a-174-22e(d)(4)(C) for the turbines and RCSA Section 22a-174-22e(d)(6)(B) for the IC engines.

Because the turbines are, by definition, “affected units” (i.e. fossil fuel-fired stationary source that serves a generator with a nameplate capacity of 15 MW or more), the turbines are also subject to the seven-month average non-ozone season emissions limit (0.15 pound/MMBtu) specified in RCSA Section 22a-174-22e(d)(4)(D). Compliance with this limit, however, cannot be demonstrated with NOx emissions testing conducted pursuant to RCSA Section 22a-174-22e(l) which consists of three one-hour tests conducted at 90% or more of the maximum rated capacity. As can be seen for the data in Table 5, the turbines cannot meet the emissions limit with HPWI.

Table 5 – Comparison of NOx Emissions Rates of Technically Feasible Controls				
Unit ID	Uncontrolled Emissions Rate (lb/MMBtu)	Control Technology	Controlled Emissions Rate (lb/MMBtu)	Sec 22e(d) Emissions Limit (lb/ MMBtu)
Devon 10	0.712	SCR	0.18	0.19
		HPWI	0.285	
Middletown 10	0.647	HPWI	0.259	0.19
Branford 10	0.678	HPWI	0.271	0.19
Franklin Drive 10	0.659	HPWI	0.264	0.19
Torrington Terminal 10	0.721	HPWI	0.288	0.19
Montville 10	2.51	SCR	0.5	0.5
Montville 11	2.41	SCR	0.5	0.5

NRG Energy evaluated dry low-NOx combustors (DLNC) for the turbines as part of a study of NOx control technologies required by TAO #8300 submitted in April 2011. NRG Energy eliminated the technology from further evaluation because the DLNC retrofits were unreliable and the retrofit package was no longer available. NRG Connecticut did not include DLNC in the case-by-case reasonably available control technology (RACT) demonstration because the technology was primarily designed for gas-fired units and attempts to adapt the technology for liquid fuel-fired units was unsuccessful. As a result, further development was abandoned.

NRG Connecticut calculated the NOx reduction efficiency, annualized cost and cost effectiveness for each of the technically feasible control technologies. The annualized cost and cost effectiveness were calculated using the *Air Pollution Control Cost Effectiveness Assessment Template* developed by the Department to support a request for a case-by-case RACT determination by providing an acceptable method for calculating the cost effectiveness of SCR, selective non-catalytic reduction (SNCR) and HPWI retrofits. Table 8-4 of EPA’s financial assumption guidance¹ specifies a 15 year book life for retrofits. NRG Connecticut used this number in the cost calculations for all subject unit. NRG Connecticut used the requested allowable

¹ Environmental Protection Agency. *Power Sector Modeling Platform v.5.13, Chapter 8 Financial Assumptions*. https://www.epa.gov/sites/production/files/2015-08/documents/chapter_8_financial_assumptions.pdf

hours of operation limits to calculate the cost effectiveness for Middletown 10 (500 hours/year) and Devon 10 (465 hours/year). Subdivisions (D) and (E) of RCSA Section 22a-174-22e(h)(6) allows the cost calculations to be made based on the requested limit on potential emissions. The default retrofit factor of 1 was used in calculating the costs for Middletown 10 and Devon 10 as these turbines are located at NRG-owned sites.

NRG Connecticut calculated the annualized cost and cost effectiveness for the GPLPE units (Branford 10, Franklin Drive 10 and Torrington Terminal 10) using 580 hours/year operating limit. The 580 hours/year operating limit is an estimate of number of hours the turbines could run at full capacity with emissions remaining under the Title V source emission levels (i.e. less than 50 tons/year). However, these units are registered under the GPLPE 50 and potential emissions are limited to 25 tons/year. NRG Connecticut used a retrofit factor of 1.5 in their calculations for the GPLPE turbines because of the added expense associated with working at the Eversource substations in proximity to high-voltage equipment. Therefore, values calculated are conservative estimates of the actual cost effectiveness.

NRG Connecticut used the default retrofit factor in calculating the costs for Montville 10 and Montville 11 as they are located at NRG-owned site. The collateral condition on Montville 10 and Montville 11 contained in Permit #107-0012 limiting total combined fuel use for both engines to no more than 80,000 gallons/year corresponds to a limit of approximately 372 hours/year of combined runtime. NRG Connecticut calculated the annualized cost and cost effectiveness using 372 hours/year for each engine (i.e. as if each engine was limited to 372 hours/year, not both) resulting in a conservative estimates of the control costs. The estimated NOx reduction efficiency and the results of the cost calculations are summarized in Table 6 for each of the technically feasible control technologies.

Table 6 - Control and Cost Effectiveness of Technically Feasible Control Technologies

Emissions Unit	Control Technology	Control Effectiveness (%)	Annualized Cost (\$/year)	Cost Effectiveness (\$/ton)
Devon 10	SCR	74.7	\$674,292	\$22,321
	HPWI	60	\$332,304	\$13,699
Middletown 10	HPWI	60	\$334,791	\$14,704
Branford 10	HPWI	60	\$451,252	\$16,237
Franklin Drive 10	HPWI	60	\$468,158	\$15,165
Torrington Terminal 10	HPWI	60	\$460,278	\$14,917
Montville 10	SCR	80.1	\$180,395	\$17,297
Montville 11	SCR	79.3	\$180,151	\$18,178

The cost effectiveness calculated for all of the technically feasible control technologies available for the subject units are greater than the economic feasibility threshold of \$13,635/ton of NOx

reduced for a Phase 2 demonstration. Based on these results, NRG Connecticut has demonstrated that the technically feasible control technologies available for the subject emissions units are not economically feasible.

Public Participation

According to RCSA Section 22a-174-22e(h)(9)(A), prior to submitting a case-by-case application, an owner/operator is required to publish a notice informing the public of the request for a case-by-case RACT determination in a newspaper of general circulation in the area in which the emissions unit operates and holding a public informational hearing to explain the purpose of and basis for the request if any request for such hearing is made. RCSA Section 22a-174-22e(h)(9)(B) requires the owner/operator to notify the chief elected official of the municipality in which the subject emissions unit is located.

NRG Connecticut certified that notices were published in the newspapers identified in Table 7 on the dates indicated and a notification letter was sent to the chief elected official of each of the respective municipalities. For each municipality, a copy of the notice, a notarized certificate of publication and a copy of the letter sent to the chief elected official was submitted with the case-by-case application. Because NRG Connecticut received no requests for a hearing, no hearings were held. It appears that NRG Connecticut has satisfied all public participation requirements specified in Subdivisions (9) through (12) of RCSA Section 22a-174-22e(h).

Table 7 - Public Notification

Municipality	Publication	Date Published	Chief Elected Official	Date of Letter
Devon	Milford Mirror	12/20/2018	Mayor Blake	12/14/2018
Middletown	Middletown Press	12/14/2018	Mayor Drew	12/14/2018
Branford	New Haven Register	12/14/2018	First Selectman Cosgrove	12/14/2018
Torrington	Register Citizen	12/14/2018	Mayor Carbone	12/14/2018
Montville	The Day	12/14/2018	Mayor McDaniel	12/14/2018

Phase 2 NOx RACT Determination.

NRG Connecticut demonstrated that no NOx control technologies that are technically and economically feasible are available for the subject emissions units. The recommended case-by-case NOx emissions limits for the subject units are listed in Table 8. For the turbines the recommended emissions limits are equal to the full-load emissions rates (FLERs) specified in TAO #8366A. For Devon 10 the recommended emissions limit is also equal to the NOx emissions rate limit specified in Permit #105-0026. For the internal combustion (IC) engines the recommended emissions limits are equal to the emissions rate limit specified in Permit #107-0012. Consent Order #8377 prohibits NRG Connecticut from exceeding these limits on and after June 1, 2023 and requires NRG Connecticut to demonstrate compliance with the NOx emissions limits through emissions testing performed in accordance with RSCA Section 22a-174-22e(l). In addition, the order limits Middletown Power to combusting no more than 850,000 gallons of fuel during any

consecutive 12 month period in Middletown 10 and limits Devon Power to combusting no more than 874,000 gallons of fuel during any consecutive 12 month period in Devon 10.

Table 8 – Phase 2 NOx RACT Determination

Unit ID	NOx Emissions Limit (pound/MMBtu)
Devon 10	0.74
Middletown 10	0.67
Branford 10	0.8
Franklin Drive 10	0.8
Torrington Terminal 10	0.8
Montville 10	2.61
Montville 11	2.61

Air Quality Benefit

RCSA Section 22a-174-22e(h)(1)(C) requires that a case-by-case RACT demonstration provide a net air quality benefit including real and quantifiable reductions in NOx emissions from any facility in Connecticut under control of the owner/operator submitting the demonstration. The owner/operator must calculate the NOx emissions reductions achievable by implementing the recommended emissions limits and additional actions and compare that emissions reductions to the NOx emissions reductions that would have occurred if the emissions units complied with the emissions limits specified in RCSA Section 22a-174-22e(d). RCSA Section 22a-174-22e(h)(8) does not allow the reduction in potential emissions of NOx associated with the imposition of a limit on fuel use, raw materials processed or hours of operation to be included as a net air quality benefit.

Potential and estimated actual emissions calculations were made to quantify the net air quality benefit of the proposal. Annual uncontrolled and controlled emissions for the boilers were calculated and compared to determine the annual emissions reductions of controls on the boilers. Annual uncontrolled emissions for the turbines and IC engines and the annual emissions that would have occurred if the turbines and IC engines complied with the emissions limits specified in RCSA Section 22a-174-22e(d) were calculated and compared to determine the annual excess emissions resulting from the proposed NOx RACT determination for the subject emissions units. As required by RCSA Section 22a-174-22e(h)(8), the limits on hours of operation were not used in the potential emissions calculations for Devon 10 and Middletown 10. The “actual” annual NOx emissions calculations assumed that the dispatch profiles of emissions units would remain similar to those experienced during 2014 through 2018 and emissions calculations are based on the 2014 through 2018 average fuel use/heat input for each unit. These calculations are provided in Attachment 2.

The annual emissions benefit of controls were used to calculate the total benefit of controls in the Phase 1 compliance period. The annual excess emissions resulting from the NOx RACT determination were used to calculate the total excess emissions in the Phase 2 compliance period. As can be seen from the results summarized in Table 9 and Table 10, the compliance plan provides

a potential net air quality benefit of 1,152 tons of NO_x and an estimated actual net air quality benefit of 4.0 tons NO_x.

Table 9 - Potential Net Air Quality Impacts (tons NO_x)

	Potential Benefit of Controls			Potential Excess Emissions for Turbines and IC Engines
	MD Unit 4	MV Unit 5	MV Unit 6	
2020	410	100		
2021	615	100	816	
2022	615	100	816	
2023	256	42	340	363
2024				622
2025				622
2026				622
2027				622
2028				207
Totals	1,896	342	1,972	3058
	4,210			

Potential Net Air Quality Benefit = 1,152 tons NO_x

Table 10 – Estimated Actual Net Air Quality Impacts (tons NO_x)

	Estimated Actual Benefit of Controls			Estimated Actual Excess Emissions for Turbines and IC Engines
	MD Unit 4	MV Unit 5	MV Unit 6	
2020	3.5	1.0		
2021	5.3	1.0	7.0	
2022	5.3	1.0	7.0	
2023	2.2	0.4	2.9	3.9
2024				6.64
2025				6.64
2026				6.64
2027				6.64
2028				2.2
Totals	16.3	3.4	16.9	32.6
	36.6			

Average “Actual” Net Air Quality Benefit = 4.0 tons NO_x

Discrete Emissions Reduction Credits (DERCs)

TAO #8365 authorizes NRG Connecticut to use and generate DERCs for Middletown Unit 2, Middletown Unit 3, Middletown Unit 4, Montville Unit 5 and Montville Unit 6. Paragraph B.11 of TAO #8365 requires that ten percent of any DERCs generated are retired prior to use to provide an environmental benefit. The number of DERCs used for the operation of Middletown Unit 4, Montville Unit 5 and Montville Unit 6 are listed in Table 11. During 2014 through 2018 Middletown Unit 4 generated 9 DERCs and Montville Units 5 and 6 generated 24 DERCs.

Table 11 - 2104 – 2018 DERC Use - Boilers

	Middletown Unit 4	Montville Unit 5	Montville Unit 6	Total
2014	30	0	7	37
2015	1	0	22	23
2016	0	0	0	0
2017	0	0	4	4
2018	53	7	21	81
Total:	84	7	54	145

To ensure that the emissions reduction benefits of early control are not lost to DERC trading, Consent Order #8377 requires NRG Connecticut to retire 250 banked DERCs within 60 days after the issuance of the order. In addition, the proposed order requires NRG to retire any DERCs generated by Middletown Unit 4, Montville Unit 5, or Montville Unit 6 on and after January 1, 2020. This retirement of DERCs is in lieu of the ten percent of DERCs required to be retired by Paragraph B.11 of TAO #8365.

The order expires on May 1, 2028, at which time NRG Connecticut will be required to operate the subject emissions units in compliance with the applicable emissions limits and other requirements of RCSA Section 22a-174-22e or cease operation.

**Attachment 1
2014 – 2018 Emissions**

Devon 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	17,032	2,299	0.82	10,084	1,361	0.48	6,948	938	0.33
2017	32,851	4,435	1.58	22,058	2,978	1.06	10,793	1,457	0.52
2016	29,487	3,981	1.42	11,683	1,577	0.56	17,804	2,404	0.86
2015	18,147	2,450	0.87	10,536	1,422	0.51	7,611	1,027	0.37
2014	22,780	3,075	1.09	-	-	-	22,780	3,075	1.09
2014 - 2018 Average	24,059	3,248	1.16	10,872	1,468	0.52	3,187	1,780	0.63

NOx Emissions rate = 0.712 lb/MMBtu

Middletown 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	35,896	4,846	1.57	24,626	3,325	1.08	11,270	1,521	0.49
2017	39,107	5,279	1.71	21,578	2,913	0.94	17,529	2,366	0.77
2016	41,277	5,572	1.80	32,423	4,377	1.42	8,854	1,195	0.39
2015	37,372	5,045	1.63	36,731	4,959	1.60	641	87	0.03
2014	23,695	3,199	1.03	-	-	0.00	23,695	3,199	1.03
2014 - 2018 Average	35,469	4,788	1.55	23,072	3,115	1.01	12,398	1,674	0.54

NOx Emissions rate = 0.647 lb/MMBtu

Branford 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	30,115	4,066	1.38	13,768	1,859	0.63	16,347	2,207	0.75
2017	50,061	6,758	2.29	35,044	4,731	1.60	15,017	2,027	0.69
2016	62,011	8,371	2.84	54,410	7,345	2.49	7,601	1,026	0.35
2015	17,351	2,342	0.79	11,692	1,578	0.54	5,659	764	0.26
2014	11,742	1,585	0.54	-	-	0.00	11,742	1,585	0.54
2014 - 2018 Average	34,256	4,625	1.57	22,983	3,103	1.05	11,273	1,522	0.52

Emissions rate = 0.78 lb/MMBtu

Franklin Drive 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	35,682	4,817	1.59	18,058	2,438	0.80	17,624	2,379	0.78
2017	41,064	5,544	1.83	28,595	3,860	1.27	12,469	1,683	0.55
2016	25,696	3,469	1.14	17,330	2,340	0.77	8,366	1,129	0.37
2015	42,883	5,789	1.91	12,245	1,653	0.54	30,638	4,136	1.36
2014	21,652	2,923	0.96	-	-	-	21,652	2,923	0.96
2014 - 2018 Average	33,395	4,508	1.49	15,246	2,058	0.68	18,150	2,450	0.81

Emissions rate = 0.659 lb/MMBtu

Torrington Terminal 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	33,828	4,567	1.65	11,464	1,548	0.56	22,364	3,019	1.09
2017	53,773	7,259	2.62	39,436	5,324	1.92	14,337	1,935	0.70
2016	13,516	1,825	0.66	5,552	750	0.27	7,964	1,075	0.39
2015	27,011	3,646	1.31	17,059	2,303	0.83	9,952	1,344	0.48
2014	27,654	3,733	1.35	24,239	3,272	1.18	3,415	461	0.17
2014 - 2018 Average	31,156	4,206	1.52	19,550	2,639	0.95	11,606	1,567	0.56

Emissions rate = 0.721 lb/MMBtu

Montville 10

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	5,847	789	0.99	2,393	323	0.41	3,454	466	0.59
2017	806	109	0.14	-	-	0	806	109	0.14
2016	1,208	163	0.20	740	100	0.13	468	63	0.08
2015	1,244	168	0.21	671	91	0.11	573	77	0.10
2014	17,683	2,387	3.00	421	57	0.07	17,262	2,330	2.92
2014 - 2018 Average	5,358	723	0.91	845	114	0.14	4,513	609	0.76

Emissions rate = 2.51 lb/MMBtu

Montville 11

year	annual			ozone-season			non-ozone-season		
	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)	Fuel Use (gal)	Heat Input (MMBtu)	NOx Emissions (tons)
2018	6,207	838	1.01	2,393	323	0.39	3,814	515	0.62
2017	808	109	0.13	-	-	0	808	109	0.13
2016	1,208	163	0.20	740	100	0.12	468	63	0.08
2015	1,157	156	0.19	671	91	0.11	486	66	0.08
2014	16,748	2,261	2.72	421	57	0.07	16,327	2,204	2.66
2014 - 2018 Average	5,226	705.46	0.85	845	114	0.14	4,381	591	0.71

Emissions rate = 2.41 lb/MMBtu

Assumed Gross Heat Value of Fuel = 0.135 MMBtu/gal

**Attachment 2
Annual Emissions Calculations**

Potential Emissions Calculations:

(Potential Emissions = Maximum Capacity x Potential Hours of Operation x Emissions Rate / 2000 pounds/ton)

Unit ID	Maximum Rated Capacity (MMBtu/hr)	Uncontrolled Emissions Rate (#/MMBtu)	Controlled Emissions Rate (#/MMBtu)	Potential Emissions (tons/year)		
				Uncontrolled	Controlled	Emissions Benefit of Controls
Middletown Unit 4	4,684	0.23	0.2	4,719	4,103	615
Montville Unit 5	995	0.173	0.15	754	654	100
Montville Unit 6	4,658	0.23	0.19	4,692	3,876	816

No enforceable limit on hours of operation of boilers, 8760 hours/year used in calculations

Unit ID	Maximum Capacity (MMBtu/hr)	Operating Limit (hr/year)	Proposed Emissions Limit (lb/MMBtu)	Sec 22e(d) Emissions Limit (#/ MMBtu)	Potential Emissions (tons/year)		
					Uncontrolled	section 22e(d)	Theoretical Benefit of section 22e(d) Limits
Devon 10	254	563	0.74	0.19	53.7	13.6	40.1
Middletown 10	244	8760	0.67	0.19	716	203	513
Branford 10	245	250	0.8	0.19	24.5	5.8	18.7
Franklin Drive 10	256	250	0.8	0.19	25.6	6.1	19.5
Torrington Terminal 10	256	250	0.8	0.19	25.6	6.1	19.5
Montville 10	29	372	2.61	0.5	14.1	2.7	11.4
Montville 11	29		2.61	0.5			
Totals:					859.5	237.3	622

Combined PTE for both IC engines based on combined fuel-use limit in Permit #107-0012

Hours of operation for Branford 10, Franklin Drive 10 and Torrington Terminal 10 are limited by GPLPE emissions limit.

Hours of operation for Devon 10 limited by 1.06 MM-gallon/year fuel use limit in Permit #105-0026

Estimated Actual Emissions Calculations

(Estimated Actual Emissions = Average Historic Heat Input x Emissions Rate / 2000 pounds/ton)

Unit ID	2014-2018 Average Annual Heat Input (MMBtu/year)	Uncontrolled Emissions Rate (#/MMBtu)	Controlled Emissions Rate (#/MMBtu)	2014 - 2018 Estimated "Actual" Emissions (tons/year)		
				Uncontrolled	Controlled	Emissions Benefit of Controls
Middletown Unit 4	350,635	0.23	0.2	40.3	35.1	5.3
Montville Unit 5	82,831	0.173	0.15	7.2	6.2	1.0
Montville Unit 6	348,198	0.23	0.19	40.0	33.1	7.0

Unit ID	2014-2018 Average Annual Fuel Use (gal)	2014-2018 Average Annual Heat Input (MMBtu)	Uncontrolled Emissions Rate (#/MMBtu)	Sec 22e(d) Emissions Limit (#/ MMBtu)	2014 - 2018 Average "Actual" Emissions (tons/year)		
					Uncontrolled	sec 22e(d)	Theoretical Benefit of sec 22e(d) Limits
Devon 10	24,059	3,248	0.712	0.19	1.16	0.31	0.8
Middletown 10	35,469	4,788	0.647	0.19	1.55	0.45	1.1
Branford 10	34,256	4,625	0.678	0.19	1.57	0.44	1.1
Franklin Drive 10	33,395	4,508	0.659	0.19	1.49	0.43	1.1
Torrington Terminal 10	31,156	4,206	0.721	0.19	1.52	0.40	1.1
Montville 10	5,358	723	2.51	0.5	0.91	0.18	0.7
Montville 11	5,226	705	2.41	0.5	0.85	0.18	0.7
Totals:					9.03	2.39	6.64

Heat value of fuel oil = 0.135 MMBtu/gallon