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| VCMRR Number | [041](https://www.ercot.com/mktrules/issues/VCMRR041) | VCMRR Title | **SO2 and NOX Emission Prices Used in Verifiable Cost Calculations** |
| Date Posted | April 24, 2024 |
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| Requested Resolution  | Normal  |
| Verifiable Cost Manual Sections Requiring Revision  | 2.6, Additional Rules for Submitting Emission CostsAppendix 5, Specification of Relevant Equations |
| Related Documents Requiring Revision/Related Revision Requests | None |
| Revision Description | This Verifiable Cost Manual Revision Request (VCMRR) removes the requirement to use indices for the price of sulfur dioxide (SO2) and nitrogen oxide (NOX) and replaces them with fixed prices to calculate emission costs.  |
| Reason for Revision |  [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 1 – Be an industry leader for grid reliability and resilience [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 2 - Enhance the ERCOT region’s economic competitiveness with respect to trends in wholesale power rates and retail electricity prices to consumers [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 3 - Advance ERCOT, Inc. as an independent leading industry expert and an employer of choice by fostering innovation, investing in our people, and emphasizing the importance of our mission Administrative Regulatory requirements ERCOT Board/PUCT Directive*(please select ONLY ONE – if more than one apply, please select the ONE that is most relevant)* |
| Justification of Reason for Revision and Market Impacts | Currently, ERCOT must purchase an annual emissions price index subscription to calculate monthly emissions costs. This VCMRR eliminates that requirement, resulting in reduced costs to ERCOT and replacing the index for SO2 and NOX emissions with fixed prices set at $2/short ton and $3/short ton, respectively. ERCOT is proposing this change given that SO2 and NOX emissions prices have not changed in value since 2019, with only an insignificant change during that same year. Over the last four years the prices of SO2 and NOX have remained constant at about $2/short ton and $3/short ton, respectively. Only during the period of January 2019 through July 2019 did SO2 prices drop to approximately $1.7/short ton and NOX prices increase to $3.51/short ton. Moreover, prior to that period, prices have been very similar to current values since 2017. Therefore, it appears that there has not been a competitive market for SO2 and NOX emissions for several years.ERCOT recognizes that emissions costs might vary in the future due to changes in the marketplace. To this end, ERCOT proposes that fixed prices be used either until (1) new EPA requirements substantially affecting SO2 and NOX emissions prices go into effect, (2) ERCOT determines that a competitive market for SO2 and NOX exists, or (3) as directed by TAC. Adopting these changes should not impact the emissions costs to generators as ERCOT will continue to use the same emissions prices it has been using since 2020. Typical emissions costs for the operation of Generation Resources with approved Verifiable Costs are shown below, on a $/MWh basis, for a generator with an average heat rate of 12MMBtu/MWh:

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| --- | --- | --- | --- |
| Operational Emissions | Minimum ($/MWh) | Median ($/MWh) | Maximum ($/MWh) |
| NOX | 0.00 | 0.00072 | 0.013 |
| SO2 | 0.00 | 0.0000072 | 0.0081 |

Clearly, using current index prices for SO2 and NOX to calculate emissions cost rates results in a very small component of a typical variable Operations & Maintenance (O&M) rate of about $6/MWh to $8/MWh. Using fixed prices for SO2 and NOX will continue to provide this incremental emissions costs benefits but at a lower cost to ERCOT by eliminating the cost of the subscription. |

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| Market Segment | Not Applicable |

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| Proposed Verifiable Cost Manual Language Revision |

**2.6** **Additional Rules for Submitting Emission Costs**

(1) Verifiable Cost data may include the cost of purchasing emission credits but only to the extent necessary to meet environmental regulations associated with the operation of the specific Resource. ERCOT will not approve emission costs of any type unless they are sufficiently documented. When submitting emission costs the following procedures apply:

(a) Filing Entities submitting emission costs per-start must do so for each start type, cold, hot and intermediate. ERCOT will calculate Verifiable Startup Emission Costs ($/start) for a Resource by using Equation 4 described in Section 14, Appendices, Appendix 5, Specification of Relevant Equations.

(b) Emission costs incurred while operating the Resource at the Minimum-Energy level or above Low Sustained Limit (LSL) are calculated on a $/MWh basis. ERCOT will calculate Verifiable emission costs ($/MWh) at LSL by using Equation 5 described in Section 14, Appendices, Appendix 5.

(c) Resources may include the cost of NOX, and SO2 emissions requirements as part of the Verifiable Cost for:

(i) Non-attainment Area for NOX in Houston-Galveston-Brazoria

(ii) The Clean Air Interstate Rule (CAIR) or other federal regulations for NOX and SO2, using Equations 4 and 5 as described in Section 14, Appendices, Appendix 5.

(d) For verifying the emission rates, the Filing Entity may submit the historic calendar annual average for the unit-specific emission rates reported to Texas Commission on Environmental Quality (TCEQ) and or Environmental Protection Agency (EPA) by April 30 of the applicable year, if deemed necessary by the Filing Entity.

(e) SO2 and NOX emissions prices will be set at $2/short ton and $3/short ton, respectively, until new EPA requirements substantially affecting SO2 and NOX emissions prices go into effect, ERCOT determines that a competitive market for SO2 and NOX has developed and the fixed prices are not reflective of the competitive market prices, or if ERCOT is directed to do so by TAC. If any of these conditions are met, at such time emission prices for SO2 and NOX will be obtained by ERCOT and will be based on average monthly index prices selected by ERCOT that are generally accepted in the industry and regularly published. Using emission index prices, ERCOT will calculate monthly indices using the arithmetic average of the prices published during business days for the first 15 days of the month prior to the effective month.

(f) If ERCOT chooses index prices for SO2 and NOX as described in paragraph (1)(e) above, ERCOT will disclose to Market Participants the source of its selected price indices, along with descriptions of the nature and derivation of the indices as available from the publishers of those indices.

(g) In the event that an ERCOT selected index, pursuant to paragraph (1)(e) above, becomes unavailable or unsuitable for the intended purpose, ERCOT will select a substitute index source, if applicable. ERCOT will notify Market Participants of any change in the index, along with a description of the nature and derivation of the substitute index and a summary of the reasons for the change, 60 days prior to the beginning of its use. However, in the event that 60 days notice cannot be given for any reason, ERCOT will notify Market Participants as far prior to use as practical.

(h) On a monthly basis, ERCOT will recalculate each Resource’s emission costs for SO2 and NOX utilizing the emission prices as described in paragraph (1)(e) above. The new emission costs will replace the emission costs in the previously approved Operations & Maintenance (O&M) Verifiable Costs totals.

(i) ERCOT emission cost calculations for each Resource will be completed and the new approved O&M Verifiable Costs will be made available to Filing Entities eight days prior to the first day of each effective month. The effective period for use of these new emission costs will be the first day of each calendar month through the end of the same month.

(j) As a trading market develops pertaining to emissions limits at a state and or regional level, the costs associated to comply with emission restrictions may be eligible to be recovered and be part of the Verifiable Cost methodology. At the appropriate time, any market participant may propose a methodology to the Wholesale Market Subcommittee (WMS) to recuperate the emission costs in the applicable non-attainment area, which will be addressed in the Verifiable Cost Manual.

**Appendix 5: Specification of Relevant Equations**

**Equation 1: Verifiable Startup Offer Cap ($/Start)**

Verifiable Startup Offer Cap ($/Start) = DAFCRS (MMBtu/Start) \* [(GASPERSU\*FIP + OILPERSU\*FOP)/100] + VOMS

Where: DAFCRS = Total Fuel \* (1+VOXR)

 Total Fuel = [FuelStartup-BC + FuelBC-LSL + FuelBO-Shutdown]

The bill determinants utilized above are defined as:

DAFCRS = the adjusted verified fuel consumption for the start type (MMBtu/Start)

 GASPERSU = Percentage of natural gas used for a start

 FIP = Fuel Index Price ($/MMBtu)

 OILPERSU = Percentage of oil used for a start

 FOP = Fuel Oil Price ($/MMBtu)

VOMS = the verified O&M cost for a hot start ($/Start)

VOXR= Value of X for the Resource

FuelStartup-BC= Fuel quantity required to bring Resource from Startup to Breaker Close (MMBtu)

FuelBC-LSL= Fuel quantity required to bring Resource from Breaker Close to Minimum Energy at LSL (MMBtu)

FuelBO-Shutdown= Fuel quantity required to take Resource from Breaker Open to Shutdown (MMBtu)

Note 1: GASPERSU and OILPERSU are decimal percentages in the Settlements equations and will be multiplied by 100 during the Integration process.

Note 2: ERCOT will use the solid fuel price and percentages to create Startup offers when no offer is submitted by the QSE for solid fuel Resources.

Note 3: This equation does not include any adjustments made to the final calculation of the Startup Offer cap, as described in Protocol Section 4.4.9.2.1, Startup Offer and Minimum-Energy Offer Criteria*.*

**Equation 2: Verifiable Minimum-Energy Offer Cap ($/MWh)**

Verifiable Minimum-Energy Offer Cap ($/MWh) = AHR\*[(GASPERME\*FIP + OILPERME\*FOP)/100] + VOMLSL

Where: AHR(1)= Fuel Rate (MMBtu/Hour) divided by LSL (MW)

 GASPERME = Percentage of natural gas used at LSL

 FIP = Fuel Index Price ($/MMBtu)

 OILPERME = Percentage of oil used at LSL

 FOP = Fuel Oil Price ($/MMBtu)

VOMLSL = the verified O&M cost at Minimum-Energy ($/MWh)

(1) Adjusted by VOXR

And: AHR= (verified fuel consumption/LSL)\*(1+VOXR)

Note 1: GASPERME and OILPERME are decimal percentages in the Settlements equations and will be multiplied by 100 during the Integration process.

Note 2: ERCOT will use the solid fuel price and percentages to create Startup offers when no offer is submitted by the QSE for solid fuel Resources.

Note 3: This equation does not include any adjustments made to the final calculation of the Minimum-Energy Offer cap, as described in Protocol Section 4.4.9.2.1, Startup Offer and Minimum-Energy Offer Criteria*.*

**Equation 3: Calculation of Composite Unit Parameters using Alternate Unit Specifications**

Composite Unit Parameter = [Alt\_Unit\_Par\*Alt\_Unit\_HSL + Non\_Alt\_Unit\_Par\* Non\_Alt\_Unit\_HSL] / [Alt\_Unit\_HSL + Non\_Alt\_Unit\_HSL]

Where: Alt\_Unit\_Par = Relevant parameter of Alternate Unit

Alt\_Unit\_HSL = High Sustained Limit of Alternate Unit

Non\_Alt\_Unit\_Par = Relevant parameter of non-Alternate Unit

Non\_Alt\_Unit\_HSL = High Sustained Limit of non-Alternate Unit

This calculation would be executed for all relevant parameters of the alternate and non-alternate units. This would include for example Startup Cost data, Minimum-Energy Cost data and heat rate data.

**Equation 4: Equation for Calculation of Verifiable Startup Emission Costs**

Verifiable Startup Emission Cost ($/Start) = RAFCRS \* ∑Emission Rate i \* Emission Cost Index i

Where RAFCRS **=** Quantity of approved startup fuel consumed by Resource (including fuel used to shutdown Resource (MMBtu/Start)

 Emission Rate i = Quantity of emission i emitted by resource (lbs/MMBtu)

Emission Cost Indexi **=** Fixed price or published cost index of emission i ($/lb)

i = Index for each emittent approved for inclusion in Startup Cost

**Equation 5: Equation for Calculation of Verifiable Minimum-Energy Emission Costs**

Verifiable Minimum-Energy Emission Costs ($/MWh) =

 [AHR] \* ∑Emission Rate i \* Emission Cost Index i

Where AHR = Average heat rate at Minimum Energy (MMBtu/Hr)

 Emission Rate i = Quantity of emission i emitted by resource (lbs/MMBtu)

 Emission Cost Index i = Fixed price or published cost index of emission i

 i = Index of each emittent approved for inclusion in Minimum-Energy Cost

**Equation 6: Verifiable Startup Costs (VERISU) ($/Start)**

A) For RUC Settlements, the Verifiable Startup Costs are calculated as follows:

VERISU = AFCRS + VOMS

Where AFCRS = [Total Fuel - PHR \* AVGEN + Total Fuel\*VOXR] \* [FIP\*GASPERSU(%) + FOP\*OILPERSU(%) + SFP\*SFPERSU(%)]

Total Fuel = [FuelStartup-BC + FuelBC-LSL + FuelBO-Shutdown]

VOMS = IO&MStart-LSL +IO&MBO-Shutdown + Verifiable Startup Emission Costs

B) For DAM Make-Whole Payments, the Verifiable Startup Costs are calculated as follows:

VERISU = DAFCRS + VOMS

Where DAFCRS = [Total Fuel + Total Fuel\*VOXR] \* [FIP\*GASPERSU(%) + FOP\*OILPERSU(%) + SFP\*SFPERSU(%)]

Total Fuel = [FuelStartup-BC + FuelBC-LSL + FuelBO-Shutdown]

VOMS = IO&MStart-LSL +IO&MBO-Shutdown + Verifiable Startup Emission Costs

The bill determinants utilized above are defined as:

VERISU = Verifiable Startup Costs ($/Start)

AFCRS = Verifiable Startup Fuel Costs adjusted by VOXR and PHR ($/Start)

DAFCRS = the adjusted verified fuel consumption rate for the start type (MMBtu/Start)

VOMS = Verifiable Operations and Maintenance Costs ($/Start)

FuelStartup-BC = Fuel Quantity required to bring Resource from Startup to Breaker Close (MMBtu)

FuelBC-LSL = Fuel Quantity required to bring Resource from Breaker Close to Minimum Energy at LSL (MMBtu)

FuelBO-Shutdown = Fuel Quantity required to take Resource from Breaker Open to Shutdown (MMBtu)

PHR = Proxy Heat Rate (MMBtu/MWh)

AVGEN = Average Generation between Breaker Close and LSL (MWh)

VOXR = Value of X for the Resource

FIP = Fuel Price Index for gas ($/MMBtu)

FOP = Fuel Price Index for oil ($/MMBtu)

SFP = Fuel Price Index for solid fuel = $1.50/MMBtu

GASPERSU = Percent of gas used during startup

OILPERSU = Percent of oil used during startup

SFPERSU = Percent of solid fuel used during startup

IO&MStart-LSL = Incremental O&M costs incurred to bring Resource from Start to LSL ($/Start)

IO&MBO-Shutdown = Incremental O&M costs incurred to take Resource from Breaker Open to Shutdown ($/Start)

Verifiable Startup Emission Costs = The allowable costs of acquiring emission credits required to start up Resource and defined in Equation 4 above.

**Equation 7: The Equation for calculating Verifiable Minimum Energy Costs ($/MWh)**

VERIME = FCLSL + VOMLSL

Where VERIME = Verifiable Minimum Energy Costs

 FCLSL = Verifiable Fuel Costs at Minimum Energy

 VOMLSL = Verifiable variable O&M costs at Minimum Energy

FCLSL = [(AHR)] \* [FIP\*GASPERME(%) + FOP\*OILPERME(%) + SFP\*SFPERME(%)]

Where AHR = Adjusted average heat rate at Minimum Energy (MMBtu/Hr)

 FIP = Fuel Price Index for gas ($/MMBtu)

 FOP = Fuel Price Index for oil ($/MMBtu)

 SFP = Fuel Price Index for solid fuel = $1.50/MMBtu

 GASPERME = Percent of gas used at minimum energy

 OILPERME = Percent of oil used at minimum energy

 SFPERME = Percent of solid fuel used at minimum energy

VOMLSL = IO&MLSL + Verifiable Emission Costs at Minimum Energy

Where IO&MLSL = Incremental O&M costs at minimum energy

Verifiable Emission Costs at Minimum Energy = The allowable costs of acquiring emission credits required to operate Resource at minimum energy and defined in Equation 5 above.