ERCOT Verifiable Cost Manual

January 1, 2015

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Revisions and Approval Information

Effective Date: 1/1/15
Revision History:

Date	Version	Description	Author
4/1/2011	0.20	Un-box language due to implementation of NPRR305.	Ino Gonzalez
7/14/2011	0.21	Updated handy-Whitman Index; Added language on Quick Start Generation Resources (QSGRs)	Ino Gonzalez and Dr. Jim Guy
9/15/2011	0.22	Revised Proxy Heat Rate calculation.	WMS
10/1/2011	0.23	Un-box language within Appendix 6, Calculation and Application of Proxy Heat Rate and the Value of X	WMS
7/11/2012	0.24	Revised Additional Rules for Establishing the Mitigated Cap Variable O&M Cost for QSGRs and Appendix 7, Calculation of the Variable O&M Value for Real Time Mitigation for Quick Start Generation Resources QSGRs, effective 9/1/12.	WMS
8/16/2012	0.25	Revised Additional Rules for Establishing the Mitigated Cap Variable O&M Cost for QSGRs and Appendix 7, Calculation of the Variable O&M Value for Real Time Mitigation for Quick Start Generation Resources QSGRs, effective 10/1/12.	WMS
9/12/2012	0.26	Revised Additional Rules for Establishing the Mitigated Cap Variable O&M Cost for QSGRs and Appendix 7, Calculation of the Variable O&M Value for Real Time Mitigation for Quick Start Generation Resources QSGRs, effective 10/1/12.	IMM
10/10/2012	0.27	Revised Appendix 7: Calculation of the Variable O&M Value and Incremental Heat Rate used in Real Time Mitigation for Quick Start Generation Resources (QSGRs). The following changes are grey boxed and become effective upon NPRR485, Clarification for Fuel Adder Provision. • Section 2: General Rules of Verifiable Costs; Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs). • Section 3: Verifiable Startup Costs; Adjustments to Verified Startup Fuel Consumption.	Resource Cost Working Group (RCWG)//WMS

Date	Version	Description	Author
		• Appendix 6: Calculation and Application of Proxy Heat Rate and the Value of X. • Revised Appendix 7: Calculation of the Variable O&M Value and Incremental Heat Rate used in Real Time. Mitigation for Quick Start Generation Resources (QSGRs). The following changes are grey boxed and become effective upon NPRR487, QSGR Dispatch Adjustment" • Section 2: General Rules of Verifiable Costs; Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs). The following changes are grey boxed and become effective upon WMS approval of the implementation plan. • Section 3: Verifiable Startup Costs; Adjustments to Verified Startup Fuel Consumption. • Appendix 6: Calculation and Application of Proxy Heat Rate and the Value of X.	
12/1/2012	0.28	Removed grey boxes from language associated with approval and implementation of NPRR485: • Section 2: General Rules of Verifiable Costs; Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs). • Section 3: Verifiable Startup Costs; Adjustments to Verified Startup Fuel Consumption. • Appendix 6: Calculation and Application of Proxy Heat Rate and the Value of X. • Appendix 7: Calculation of the Variable O&M Value and Incremental Heat Rate used in Real Time Mitigation for Quick Start Generation Resources (QSGRs).	WMS
12/5/2012	0.29	Aligned the Verifiable Cost Manual with the Protocols due to approval and implementation of NPRR485. Approved changes effective 1/1/13. • Section 2: General Rules of Verifiable Costs: Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs). • Section 3: Verifiable Startup Costs: Verifiable Startup Costs Policies and Submitting Startup Costs. • Section 4: Verifiable Minimum Energy Costs; Verifiable Minimum Energy Cost Policies	ERCOT

Date	Version	Description	Author
		• Section 5: Mitigated Offers and Verifiable Costs • Appendix 2: Auxiliary Data • Appendix 4: Operating and Maintenance Cost Categories • Appendix 5: Specification of Relevant Equations • Appendix 6: Calculation and Application of Proxy Heat Rate and the Value of X.	
2/13/2013	0.30	Modified the On-Line run time for QSGRs; removed references to Nodal Surcharge; and revised the change control process. Approved changes for the change control process are grey boxed and effective upon implementation of NPRR516, Change to Verifiable Cost Manual Revision Process.	RCWG
4/12/2013	0.31	Aligned the Verifiable Cost Manual with the NPRR511, Correction to Emergency Energy Settlement Language. Approved changes are effective upon implementation of NPRR511. • Section 2: General Rules of Verifiable Costs; Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs). Removed grey boxes from language associated with approval and implementation of NPRR487, QSGR Dispatch Adjustment, effective 5/1/13. • Section 2: General Rules of Verifiable Costs; Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs).	ERCOT
6/1/2013	0.32	Removed grey boxes from language associated with approval and implementation of NPRR511, Correction to Emergency Energy Settlement Language. Approved changes are effective upon implementation of NPRR511. Section 2: General Rules of Verifiable Costs; Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs).	ERCOT
6/12/2013	0.33	Clarify the treatment of seasonal costs, effective 7/1/13	ERCOT
7/10/2013	0.34	Add provision for including variable O&M costs into Mitigated Offer Cap (MOC) for power augmentation techniques.	ERCOT / WMS
8/1/2013	0.35	Removed changes for the change control process from grey boxes due to the implementation of NPRR516.	N/A

Date	Version	Description	Author
2/1/2014	0.36	Incorporation of Verifiable Cost Manual Revision Request (VCMRR) 001, Submission of Fuel Costs.	RCWG
5/1/2014	0.37	Incorporation of VCMRR002, Verifiable Costs for Cancellation of RUC- Committed Resources.	ERCOT
6/1/2014	0.38	Incorporation of VCMRR003, Administrative Changes for the June 1, 2014 Verifiable Cost Manual	ERCOT
9/1/14	0.39	Incorporation of VCMRR004, Caps for Energy Storage Resources	Chamisa Energy
10/1/14	0.40	Un-box language in Section 2 and Appendix 10 associated with VCMRR004.	Chamisa Energy
10/6/14	0.41	Un-box language in Section 3 and Appendix 6 associated with VCMRR001.	RCWG
1/1/15	0.42	Incorporation of VCMRR005, Index Fuel Price	RCWG

Change Control Process

Refer to Section 13, Verifiable Cost Manual Revision.

Introductory Information

This Manual details the rules and procedures pertaining to the Verifiable Cost Process in the Texas Nodal Market. If any provision in this document is in conflict with the Nodal Protocols, then the Protocols prevail to the extent of the inconsistency. See section 1.1 Paragraph 5 of the Nodal Protocols.

Purpose

This Manual provides an overview of ERCOT's Verifiable Cost Process. It defines Verifiable Costs and also delimits which costs are properly included within that definition. This Manual details the format and the manner in which various types of Verifiable Cost data are to be submitted to ERCOT. The Nodal Protocols allow either Qualified Scheduling Entities or Resource Entities to submit Verifiable Cost data to ERCOT. In this Manual the Entity which submits Verifiable Cost data shall be referred to as the "Filing Entity". This Manual also details the processes used by ERCOT to evaluate submitted Verifiable Cost data and also the considerations bearing on ERCOT's decision to approve or reject that data. This document establishes the procedures to be used when disputing ERCOT's treatment or rejection of submitted data. Lastly, this document details the various timelines that apply to the submission, review, approval, update, and dispute of Verifiable Costs.

Intended Audience

This Manual is primarily intended to be used by those submitting Verifiable Cost data or disputing ERCOT's treatment of submitted data. This Manual, however, is also intended for anybody wishing to learn more about the rules and procedures applicable to the Verifiable Cost Process in the Texas Nodal Market.

Global Definitions

Where this Manual uses the generic phrase "Verifiable Costs," it is intended to refer to the sum of any applicable, Verified Operating and Maintenance Costs and any appropriate, Verified Fuel Costs. ERCOT itself calculates Fuel Costs, but does so using Fuel Consumption data that have been submitted and verified. Thus, the Fuel Cost component implied by the term "Verifiable Costs" should be interpreted to mean whichever of the following is contextually appropriate:

a. Fuel Consumption per-start (MMBtu/start)
b. Fuel Consumption per-hour at LSL (MMBtu/hr)
c. Fuel Consumption as determined from submitted heat rate (a measure of generator efficiency) data

The following are several abbreviations that are used throughout this Manual and the intended meaning of each:

1. "AHR Curve" denotes Average Heat Rate Curve
2. "CCP" denotes Combined Cycle Plant
3. "FIP" denotes Fuel Index Price
4. "FOP" denotes Fuel Oil Price
5. "IHR Curve" denotes Incremental Heat Rate Curve.
6. "I/O Curve" denotes Input-Output Curve
7. "LSL" denotes Low Sustained Limit
8. "HSL" denotes High Sustained Limit
9. "Manual" refers to this document, ERCOT's Verifiable Cost Manual
10. "MMBtu" denotes one-million British Thermal Units
11. "O&M costs" denotes Operations and Maintenance costs.
12. "QSE" denotes Qualifying Scheduling Entity
13. "RUC" denotes the Reliability Unit Commitment
14. "SGR" denotes Split Generation Resource
15. "VOM" denotes Variable O&M
16. "VCMS" denotes Verifiable Cost Management System
17. "lb" denotes Pounds-Mass
18. "WMS" Wholesale Market Subcommittee
19. "LEL" denotes Low Emergency Limit
20. "HEL" denotes High Emergency Limit
21. "PPA" denotes Power Purchase and Tolling Agreements
22. "Filing Entity" denotes the Entity which files Verifiable Cost data with ERCOT, whether a Qualified Scheduling Entity or a Resource Entity.
23. "BC" denotes breaker close.
24. "VC" denotes Verifiable Costs
25. "Shutdown Costs" denotes those fuel costs (Including auxiliary boiler fuel and auxiliary-equipment fuel or electrical power requirements but excluding normal plant heating) which are incurred within three hours after Breaker Open.

[VCMRR005: Replace the paragraph above with the following upon system implementation of NPRR664:]

The following are several abbreviations that are used throughout this Manual and the intended meaning of each:

1. "AHR Curve" denotes Average Heat Rate Curve
2. "CCP" denotes Combined Cycle Plant
3. "FIP" denotes Fuel Index Price as defined in section 2 of ERCOT Nodal Protocols
4. "FOP" denotes Fuel Oil Price
5. "IHR Curve" denotes Incremental Heat Rate Curve.
6. "I/O Curve" denotes Input-Output Curve
7. "LSL" denotes Low Sustained Limit
8. "HSL" denotes High Sustained Limit

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25. "Shutdown Costs" denotes those fuel costs (Including auxiliary boiler fuel and auxiliary-equipment fuel or electrical power requirements but excluding normal plant heating) which are incurred within three hours after Breaker Open.
26. "WFP" denotes Waha Fuel Price
27. "$FIPR_r$" denotes Fuel Index Price for Resource

Section 1: An Introduction to Verifiable Costs

This section of ERCOT's Verifiable Cost Manual provides an introduction to Verifiable Costs and explains what they represent.

Verifiable Costs are a significant component in the Texas Nodal Market. They are used by ERCOT in various calculations and internal processes, including the replacement of generic generator-specific cost caps and to provide QSEs with forms of cost recovery that would otherwise be unavailable.

Verifiable Costs are used as a proxy for the costs a Resource incurs while operating. These costs are determined for, and allocated according to, the three discrete stages of the power generation cycle: startup to LSL, operation at LSL, and operation above LSL. While Verifiable Costs are calculated uniquely for each of these stages, Verifiable Costs in all stages are a function of two types of costs: Fuel Costs and Operation and Maintenance ("O&M") costs.

The Fuel Cost component of Verifiable Costs is intended to capture the fuel costs a Resource incurs while generating power during a given period. This component of Verifiable Costs is itself a function of fuel price ($/MMBtu) and the verifiable fuel consumption rate (either MMBtu/start or MMBtu/hr). When ERCOT calculates the fuel component of the Resource-specific offer caps, ERCOT uses the Fuel Index Price ("FIP") and the Fuel Oil Price ("FOP") and the corresponding percentages of each fuel submitted in the Offer. Filing Entities should not include fuel prices with their Verifiable Cost submissions. See Equations 1 and 2 of Appendix 5 for a description of the equations used by ERCOT to calculate Resource-specific offer caps.

[VCMRR005: Replace the paragraph above with the following upon system implementation of NPRR664:]

The Fuel Cost component of Verifiable Costs is intended to capture the fuel costs a Resource incurs while generating power during a given period. This component of Verifiable Costs is itself a function of fuel price ($/MMBtu) and the verifiable fuel consumption rate (either MMBtu/start or MMBtu/hr). When ERCOT calculates the fuel component of the Resource-specific offer caps, ERCOT uses the Fuel Index Price for Resource ("$FIPR_r$") and the Fuel Oil Price ("FOP") and the corresponding percentages of each fuel submitted in the Offer. Filing Entities should not include fuel prices with their Verifiable Cost submissions. See Equations 1 and 2 of Appendix 5 for a description of the equations used by ERCOT to calculate Resource-specific offer caps.

The O&M component of Verifiable Costs is intended to capture various other non-fuel, incremental (marginal) costs a Resource incurs while generating power in a given period. The O&M component of Verifiable Costs is calculated by the Resource Entity and submitted to ERCOT by the appropriate Filing Entity and then verified by ERCOT using data submitted. Both the data and the methods used to calculate these costs will vary, depending, for example, on the costs intended to be captured or on the different internal record-keeping and cost-allocation schemes implemented by Resource Entities. Additional detail is provided in subsequent sections of this Manual.

ERCOT calculates Verifiable Costs using data specific to a Resource and that is submitted by the Filing Entity. Submitted data is only valid for a single Resource (i.e., it is Resource-specific). The process of calculating Verifiable Costs begins when a Filing Entity submits, in the appropriate manner, Resource cost and/or performance data which is permitted by this document and the Nodal Protocols. ERCOT will subsequently review the submitted data and will approve ("verify") it if ERCOT finds the data to be sufficiently accurate and documented. Only after approving submitted data does ERCOT use it as a basis for calculating Verifiable Costs.

Once approved, Verifiable Cost data are used prospectively to calculate Verifiable Costs. An important exception to this rule pertains to *Event Specific Verifiable Costs*. *Event Specific Verifiable Costs* are documented costs a Resource actually incurred during a specific event and, thus, exclude amortized or discounted future costs. *Event Specific Verifiable Costs* are only relevant to *Section 8: Forced Outages of a RUC-Committed Resource*. *Event Specific Verifiable Costs* are applied retroactively (i.e., used when resettling the Operating Day on which an applicable event occurred) and only apply to the event from which they arose (i.e., must be resubmitted for all similar events and will not be used for "normal" Verifiable Costs). The phrase "Event Specific Verifiable Costs" is underlined and italicized within this Manual in an effort to increase clarity, reduce confusion, and emphasize the contrast between Verifiable Costs and *Event Specific Verifiable Costs*.

Verifiable Cost Flowcharts

Chart 1: Verifiable Startup Cost Data: Calculations and Dependencies

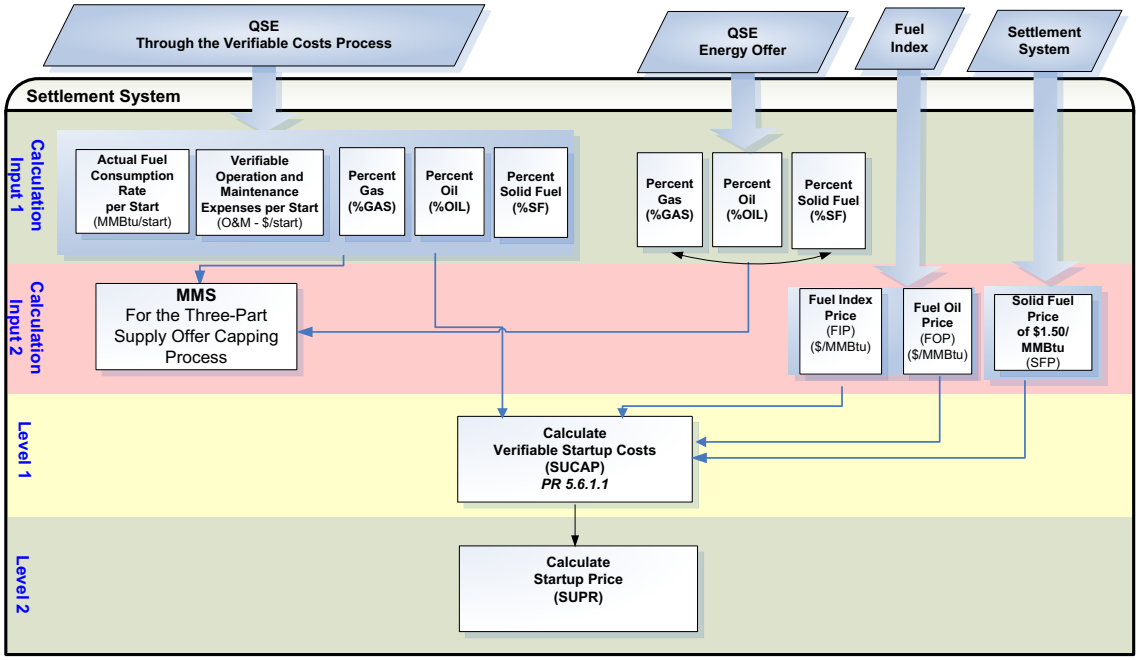

QSE
Through the Verifiable Costs Process
QSE
Energy Offer
Fuel
Index
Settlement
System
Settlement System
Calculation
Input 1
Actual Fuel
Consumption
Rate
per Start
(MMBtu/start)
Verifiable
Operation and
Maintenance
Expenses per Start
(O&M - $/start)
Percent
Gas
(%GAS)
Percent
Oil
(%OIL)
Percent
Solid Fuel
(%SF)
Percent
Gas
(%GAS)
Percent
Oil
(%OIL)
Percent
Solid Fuel
(%SF)
Calculation
Input 2
MMS
For the Three-Part
Supply Offer Capping
Process
Fuel Index
Price
(FIP)
($/MMBtu)
Fuel Oil
Price
(FOP)
($/MMBtu)
Solid Fuel
Price
of $1.50/
MMBtu
(SFP)
Level 1
Calculate
Verifiable Startup Costs
(SUCAP)
PR 5.6.1.1
Level 2
Calculate
Startup Price
(SUPR)

Chart 2: Verifiable Minimum Energy Cost Data: Calculations and Dependencies

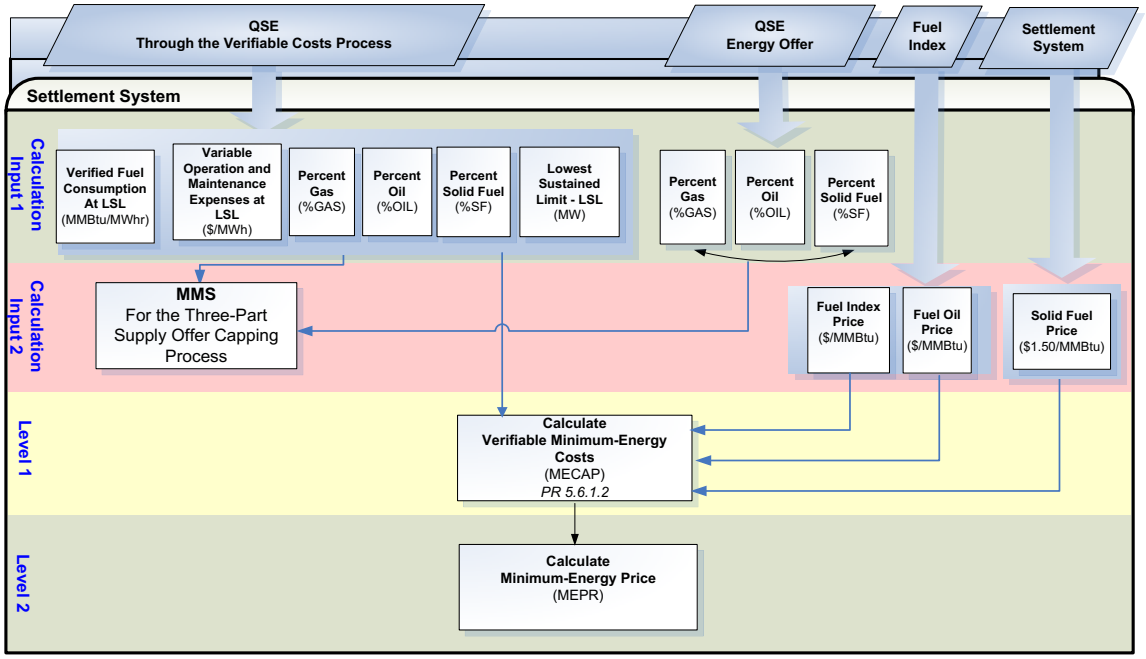
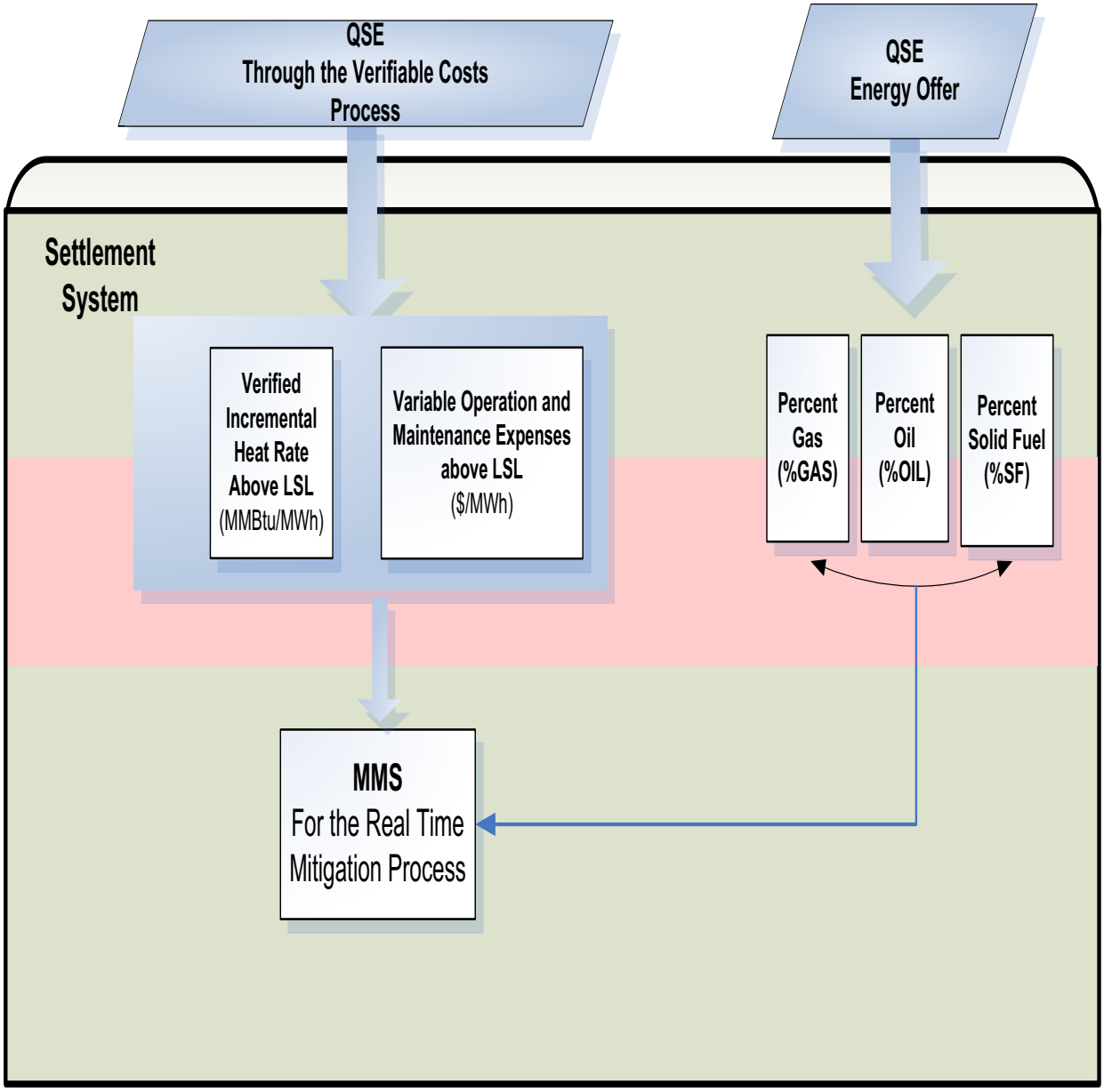


Chart 3: Real Time Mitigation Data: Calculations and Dependencies



Section 2: General Rules of Verifiable Costs

This section of ERCOT's Verifiable Cost Manual provides general rules that apply to Verifiable Cost submissions.

Generally Applicable Rules

The use of Verifiable Costs, rather than generic amounts capped according to Resource Category, is optional for a QSE that does not receive RUC instructions for a Resource. A QSE receiving RUC instructions for a Resource is required to submit Verifiable Cost data in various circumstances as described in paragraph (1) of Section 5.6.1 of the Protocols. For Filing Entities opting to submit Verifiable Cost data and also for those required to submit it, the following rules apply:

1. Verifiable Cost data must be submitted by either the Resource Entity or the QSE representing the Resource (the submitting Entity will herein be denoted the "Filing Entity") subject to the following guidelines:

    a. All RUC Instructions from ERCOT are sent to the QSE. The QSE has sole responsibility and obligation for filing verifiable costs as described under Section 5.6, RUC Cost Eligibility of the Nodal Protocols. However, if the QSE and Resource Entity agree, the Resource Entity may file verifiable cost data to satisfy the obligation of the QSE.

    b. Verifiable Costs are Resource-specific costs, regardless of who submits them. QSE costs shall not be accepted by ERCOT even when VC are submitted by the Resource Entity.

    c. If a Resource Entity wants to submit VC, then both the Resource Entity and the current QSE must sign and submit individual, separate affidavits notifying ERCOT that the Resource Entity will submit VC instead of the QSE. See Appendix 11 for standard affidavits. d. The affidavits must indicate that this arrangement will remain until the Resource Entity switches to another QSE or terminates service in the ERCOT market. If the Resource Entity switches to another QSE only the Resource Entity may submit or update VC unless new affidavits are submitted to ERCOT allowing the new QSE to submit or update or view existing VC.

    e. If the Resource Entity submits VC, both the QSE and Resource Entity must submit the standard affidavits contained in the Appendix 11 of the Manual. f. If the Resource Entity submits VC, ERCOT will NOT share specific cost documentation with the existing QSE.

    g. If the Resource Entity submits VC, ERCOT will share the final approved VC results with the QSE.

    h. Regardless of the arrangements as described above, any future requests to update VC will be sent to the QSE.

i. The QSE has the responsibility of informing the Resource Entity that it must submit or update its VC. ERCOT will not notify the Resource Entity to submit VC. However, if the QSE and Resource Entity agree to have the Resource Entity submit VC, then all discussions pertaining to VC data will be between the Resource Entity and ERCOT. Once approved, all future requests to update VC will be given to the QSE, regardless of who actually submitted VC.

j. If the Resource Entity submits VC, only the Resource Entity has accountability for the accuracy of the data. The QSE is not responsible for the accuracy of the data submitted to ERCOT by the Resource Entity.

k. If the Resource Entity submits VC, these costs will remain with the Resource even if the Resource is represented by another QSE.

l. Regardless of which entity submits VC, all disputes are associated with a settlement statement or an invoice, and therefore, only the QSE may file a dispute.

m. ERCOT will issue settlement statements and invoices only to the QSE, regardless of who submits VC.

n. If the Resource Entity submits VC, ERCOT will address all cost related issues with the Resource Entity, including rescinding previously approved costs.

o. ERCOT will NOT accept VC from two entities for the same Resource, only the QSE or Resource Entity can submit VC.

p. During the VC approval process, only the Filing Entity may appeal a specific cost category as described in the VC Manual.

2. Data must be submitted that allows for the verification of Startup costs for each Start Type (cold, hot, and Intermediate)

3. A Filing Entity is not considered to have submitted Verifiable Cost data unless data are submitted for all startup types (cold, intermediate, and hot) and for minimum energy costs.

4. ERCOT will not approve Verifiable Cost data for a Resource unless the Resource Entity has registered the Resource with ERCOT.

5. In the event that multiple Resources are tied to a fuel header, each Filing Entity submitting fuel consumption data must provide the individual meter values if available. Otherwise, the Filing Entity must provide ERCOT with the aggregate meter values and the relative percentages of fuel consumption during the relevant stage of the generation cycle (startup, operation at Low Sustained Limit (LSL), and operation above LSL).

6. All references to Heat Rate Curves and Heat Rate data within this document refer to Net Output.

7. For use in Real Time Mitigation, Filing Entities have the option of submitting, but none are required to submit, Incremental Heat Rate (IHR) curves, with the exception of RMR

Resources which are required to submit IHR curves, the incremental O&M costs of generating power at greater than LSL output. Submission of this information is also optional for QSEs that have received RUC Commitments.

8. ERCOT will not separately approve Verifiable Startup Costs and Verifiable Minimum Energy Costs. Both must be submitted and approved together.

9. If fuel consumption rates vary by season, Filing Entities must submit such seasonal costs in accordance with the procedure describe herein.

10. All submissions of Verifiable Cost data must include an affidavit that avers to the data's accuracy and authenticity and that is signed by an officer of the Filing Entity.

11. All Verifiable Costs data submitted must represent "true" costs and must be submitted in sufficient detail to allow ERCOT to validate the data.

12. Verifiable Cost documentation must be submitted to ERCOT electronically, as is described within Section 10: Timelines Applicable to the Submission and Review of Verifiable Costs. However, if ERCOT requests additional documentation for which electronic submission would be impractical, e.g., physical manuals, such documents may be submitted by mail or other courier.

13. ERCOT has authority to review and reject the Verifiable Costs it previously approved if a Filing Entity is provided with sufficient notice. Rescinded approval will only affect future Operating Days. See Section 11: Timeline for Rescinding Approval of Verifiable Costs for additional information.

14. Resources may not register as both an SGR and a CCP; therefore, ERCOT will not accept Verifiable Cost data for an SGR that is also a CCP.

15. The Filing Entity must submit to ERCOT an estimate of the average MWh produced by the Resource while ramping from BC to LSL.

16. The Filing Entity must provide the High Sustained Limit (HSL) and the LSL of the Resource in its submittal of Verifiable Cost data.

17. ERCOT may share Resource-specific Heat Rate and O&M data with its Planning group for the purpose of performing economic planning studies. ERCOT will share this information on a "need to know" basis and will continue to treat the information as Protected Information pursuant to the ERCOT Protocols.

18. Although ERCOT requires the submission of parameters (i.e. heat rates, fuel, emission and O&M rates, etc.) on a seasonal basis, if they change by season, it will utilize summer parameters for all seasons.

Exceptions for Energy Storage Resources

For the purpose of determining the Startup Offer, Minimum Energy Offer, and Mitigated Offer Cap, Energy Storage Resources that have registered with ERCOT will be treated as if they have submitted verifiable costs, as described in Appendix 10. For Energy Storage Resources that choose to submit actual verifiable costs, all rules in this manual will apply.

Additional Rules for Combined Cycle Plants

In addition, the following apply specifically to combined cycle units:

1. Verifiable Costs will only be verified for CCP configurations that are registered with ERCOT. If a Filing Entity wishes to submit Verifiable Cost data for a CCP configuration, the Filing Entity must submit costs for all units that make up that registered configuration.

2. If the Resource includes "Alternate" Units in its Resource Registration, for the purpose of determining verifiable costs for the registered configuration, ERCOT will create a composite unit by averaging the verifiable cost data of the non-Alternate Unit(s) with the verifiable cost data of the Alternate unit(s). To determine the composite unit ERCOT will weigh the data from the units using the respective HSL ratings of the units. See Equation 3 of Appendix 5 for a description of the equation used by ERCOT to determine the composite unit.

3. Filing Entities submitting Verifiable Cost data for startup or operation at LSL must submit fuel and O&M data for each configuration that has been registered. Filing Entities submitting Verifiable Cost data for operation above LSL may submit O&M data for each configuration at which the plant will be operated.

4. Input-Output ("I/O") curves need only be submitted on a per-configuration basis. If the costs incurred by individual units are determined by apportioning per-configuration costs, there must be a reasonable financial and/or engineering basis for doing so and it must be described in the Filing Entity's Verifiable Cost submission.

Additional Rules for Split Generation Resources

1. Entities representing Split Generation Resources ("SGRs") may select a Management QSE to provide ERCOT with the facility's total Verifiable Costs for the entire facility or for the Verifiable Costs of each respective Resource entity which makes up the SGR. Alternatively, QSEs may be designated for each individual Resource Entity to submit that Resource Entity's unit individual verifiable cost data which are then aggregated into the facility's total costs. Verifiable Costs and their associated cost caps may be different for each owner.

2. The Management QSE must be chosen from one of the QSEs representing the SGR. Only for purposes related to the submission of total Verifiable Costs, a QSE designated Management QSE is responsible for representing the interests of, and serving as the point-of-contact for, all entities associated with the SGR.

3. The Management QSE must notify ERCOT in writing that it will act as representative for the other SGR owners. The letter must be signed by all other SGR owners and a contact person must be listed for each.

4. Individual unit SGR costs must be consistent with the total Verifiable Costs of the generation facility. All owners of a facility should therefore participate in preparing Verifiable Cost data for submission by the Management QSE. ERCOT may compare both the individual units' costs and the SGR's total Verifiable Costs with other similar situated Generation Resources to determine the reasonability of the submitted costs.

5. Each Filing Entity must determine the individual Verifiable Costs of each SGR unit share and ensure that they are appropriately included in Verifiable Cost submissions made by the Management QSE, if appropriate.

6. The individual verifiable startup fuel (MMBtu/Start) for each SGR owner shall be equal to that owner's ownership percentage multiplied by the total facility startup fuel.

7. The verifiable fuel rate for operation at LSL (MMBtu/Hr) for each SGR owner shall be equal to that owner's ownership percentage multiplied by the total fuel rate for operation at LSL.

8. Verifiable operations and maintenance costs for startup and operation at LSL may be different for each SGR owner.

9. ERCOT may separately review and approve a Verifiable Cost submission made by an individual SGR owner. However, ERCOT retains the right to require that all SGR owners submit their individual Verifiable Costs before ERCOT approves any individual cost submissions.

10. Individual owners of an SGR may utilize different methodologies to determine their individual costs. However, costs must not be included in the Management QSE's submission more than once and, if multiple owners submit fractional shares of a cost, the sum of those shares must equal the facility's associated cost.

11. All owners must submit the same percentages of each type of fuel consumed during startup and operation at LSL.

Additional Rules for Establishing the Mitigated Offer Cap for Quick Start Generation Resources (QSGRs)

Because QSGRs are not separately compensated for Startup and Min Energy costs, the Mitigated Offer Cap (MOC) for QSGRs must include Startup O&M, Startup Fuel, and a Minimum Energy Component (MEC) for fuel at LSL (as defined below).
Below are the methods for determining how these costs are calculated for use in the ERCOT MMS system. The formulas are outlined in more detail in Appendix 7.

Startup Costs:

1. Startup O&M cost values used for Real Time Mitigation are based on either Generic or approved O&M costs from a cold start position in Quick Start mode.

2. Startup Fuel costs are determined by using 90% of the approved startup fuel (MMBtu) for a cold start, adjusted by the Value of X (VOX) outlined in Appendix 6, multiplied by the Average Fuel Index Price in the period used in the VOX calculation ($/MMBtu).

3. Startup Cost will equal the sum of the Startup O&M cost plus the Startup Fuel Cost.

Variable O&M Rate Calculation

1. Variable O&M for the start costs portion shall be calculated by using the Startup Cost calculated as described above, amortized across the expected minimum online time multiplied by 75% of the HSL.

2. Variable O&M for the run costs portion is the approved running O&M costs above LSL.

3. The Variable O&M for use in the ERCOT MMS is the sum of the start costs and run costs portions (1 and 2, above).

4. The expected minimum online time used to calculate the Variable O&M for the start costs portion is equal to the higher of the minimum online time value shown in the Resource Asset Registration (RARF), 2 hours, or 1.00 multiplied by the average actual online time for each start during the 20 consecutive days ending at 24:00 of the 9th day of the month prior to the effective month. The online time should be averaged across all the electrically and physically similar QSGRs at the same plant site weighted by the number of starts of each QSGR at the site (see Appendix 7 for additional information).

5. In determining the actual minimum online time in Paragraph 4 above, ERCOT shall exclude all hours where the QSGR is settled under the provisions of Protocols section 6.6.9, with the exception of section 6.6.9(3) or where ERCOT has manually deployed offline non-spin on the QSGR. Should these excluded hours fully encompass all hours of one start/stop cycle then the start shall also be excluded from the calculation of the average run hours.

6. The HSL used in the variable O&M rate calculation shall be based on the average of all the seasonal max sustainable rating as shown on the unit's RARF.

7. ERCOT will calculate a new variable O&M on a monthly basis.

Minimum Energy Cost Calculations:

1. Use the approved incremental heat rate.

2. For units that have approved incremental heat rate curves, a MEC is added to compensate the Resource for minimum run fuel costs. ERCOT calculates the MEC by subtracting the incremental heat rate at the midpoint of the QSGR dispatch range (HSL – LSL) from the average heat rate at the same point, where LSL represents the average seasonal min sustainable rating. This difference is added to each of the incremental heat rate points to determine the adjusted incremental heat rate curve for use in calculating the MOC.

3. The adjusted incremental heat rate (described in 2 above) is adjusted by the VOX to account for transportation and spot fuel costs as detailed in Appendix 6.

4. QSEs must notify ERCOT seasonally, via the verifiable cost process, when there is a change to the RARF HSL, LSL or minimum online time (or expected minimum online time). Notices must be given to ERCOT at least 15 days prior to the effective date for the new O&M value, which is the first day of the month for a particular season.

5. ERCOT will calculate a new adjusted incremental heat rate used in calculating the MOC for QSGRs on a monthly basis.

Additional Rules for Submitting Emission Costs

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:

1. 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 Appendix 5.

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

3. Resources may include the cost of NOx, and SO_2 emissions requirements as part of the verifiable cost for:
   a. Non-attainment Area for NOx in Houston-Galveston-Brazoria
   b. The Clean Air Interstate Rule (CAIR) or other federal regulations for NOx and SO_2, using Equations 4 and 5 as described under Appendix 5.

4. For verifying the emission rates, the Filing Entity may submit the historic calendar annual average for the unit-specific emission rates reported to TCEQ and or EPA by April 30 of the applicable year, if deemed necessary by the Filing Entity.

5. Emission prices for SO_2 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. 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.

6. 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. In the event that an ERCOT selected index becomes unavailable or unsuitable for the intended purpose, ERCOT will select a substitute index source. 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, thirty days prior to the beginning of its use. However, in the event that 30 days notice cannot be given for any reason, ERCOT will notify Market Participants as far prior to use as practical.

7. On a monthly basis, ERCOT will recalculate each Resource's emission costs for SO_2 and NOx utilizing the emission prices taken from the indices described above. The new emission costs will replace the emission costs in the previously approved O&M Verifiable Costs totals.

8. ERCOT emission cost calculations for each Resource will be completed by and the new approved O&M Verifiable Costs will be made available to Filing Entities 8 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.

9. 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 Verifiable Cost Working Group to recuperate the emission costs in the applicable non-attainment area, which will be addressed in the Verifiable Cost manual.

Additional Rules for Submission of Power Purchase and Tolling Agreements

1. The Protocols allow Power Purchase and Tolling Agreements (PPAs) to be considered as documentation of Verifiable Costs in lieu of Resource-specific data submissions. ERCOT will cap the O&M costs for Startup and for Minimum Energy Operation (at LSL). The PPA cap will be determined by ERCOT using a Reference Resource with similar characteristics as the Resource underlying the PPA. When making the assessment of caps, ERCOT will generally compare only the O&M costs stated in the PPA with the Verifiable O&M costs of the Reference Resource.

2. The QSE representing the PPA Resource is permitted to submit the actual fuel rates at Startup and Minimum Energy Operation without caps to establish the fuel component of Verifiable Costs as set forth in the Verifiable Cost Manual.

3. When there is no or insufficient data for comparable Combined Cycle (CCP) resources, ERCOT will attempt to construct a Reference Resource using a "building block" approach. ERCOT will select from the available pool of approved Combustion Turbines and Steam Turbines that are comparable to components of the PPA Resource configuration. If the building block approach fails to select a suitable Reference Resource, Resource-specific Generic Costs will be used in lieu of Verifiable Costs until such time when ERCOT can develop a Reference Resource as described herein. All newly established Reference Resources will be created on a monthly basis as described in this Manual.

Specific Guidelines for Inclusion of Power Purchase and Tolling Agreements in the Verifiable Costs Process

The following principles will govern how ERCOT will process PPAs and how QSEs submitting PPAs as documentation for Verifiable Costs must prepare their submittals to ERCOT.

1. Only PPAs covering registered Resources will be accepted by ERCOT. The identity of the Resource or Resources covered by the PPA must be specified in the PPA or declared by the QSE in supporting documentation.

2. Only QSEs offering Three-Part Supply Offers for a specific Resource covered by a PPA may submit that PPA as Verifiable Costs documentation.

3. A QSE submitting a PPA as Verifiable Cost documentation must represent one-hundred percent (100%) of the underlying Resource's capacity.

4. QSEs must submit to ERCOT a non-redacted copy of the complete PPA with all attachments.

5. The PPA must clearly define the start and end dates (effective dates) for the PPA. Only PPAs: (a) signed prior to July 16, 2008 and (b) not between affiliates, subsidiaries or partners will be accepted as Verifiable Cost documentation.

6. If a PPA does not clearly state separately the cost of Start-Up and Minimum Energy level operation, the QSE may provide to ERCOT additional documentation describing the methodology on how these costs are calculated and allocated to each cost category, startup and minimum energy levels.

7. QSEs representing PPAs must specify costs for each Start type (cold, intermediate or hot). ERCOT recognizes that aircraft derivative gas turbines may have Start-up costs by start type that are identical, or nearly identical. QSEs representing this type of PPA Resource may submit cost information accordingly, or may submit differing costs with supporting documentation. For non-aircraft derivative turbines the ERCOT expectation

is that intermediate and hot start costs will bear a relationship to cold start costs of approximately 70% and 50%, respectively, as follows:

a. Cost of hot start = Cost of cold start x 0.5
b. Cost of intermediate start = Cost of cold start x 0.7
c. QSEs representing non-aircraft derivative turbines with PPAs may submit costs by start type that deviate substantially from these relative weights, but must include supporting documentation.

8. Fuel costs for PPAs will be based upon fuel use rates of the Resources covered by the PPA, with no caps, whenever possible. This will not always be possible, as when the QSE does not submit separate values for fuel cost and O&M cost, or when ERCOT does not approve a submitted fuel use rate. ERCOT procedures in these cases will be described later in this document.

9. All PPA based Verifiable O&M Costs will be capped at the level of a Reference Resource. Caps will generally, but not always, apply only to O&M on PPAs, as noted in the preceding paragraph. Caps on Verifiable Costs will apply only to PPA covered Resources.

10. The selection of the Reference Resource used to determine O&M cost caps shall be made from a group of comparable specific Resources. Resources in this group must not be subject to any PPA, and they must have ERCOT approved Verifiable Costs. The criteria for comparability are defined in a succeeding paragraph. The Reference Resource shall be the Resource within that group with the highest ERCOT approved Verifiable O&M Costs.

11. Reference Resources will be selected and Verifiable O&M Cost caps will be calculated and applied separately for Cold start, Hot start, Intermediate start, and LSL operation. Thus, any given PPA may be compared to four different Reference Resources to establish its status for the succeeding month as “capped’ or “not capped” and four separate cap values for Verifiable Costs will be calculated and applied during a month. See Appendix 3 for examples of the process for determining Cost Caps for PPA Resources.

12. The selection of the Reference Resource for each of the four VC types (Cold, Hot, Intermediate Startup and Operation at LSL) will be done on the basis of the highest ERCOT approved Verifiable O&M Costs for a comparable non-PPA Resource for that VC type.

13. The group of Resources used to establish the Reference Resource for a given PPA and VC type will be selected on the basis of the following criteria:
    a. Same Resource technology
    b. For CCP Resources, only other CCP Resources with similar configurations will be included.
    c. Same primary fuel type
    d. High Sustained Limit (HSL) must be within plus or minus 30% of the HSL of the PPA’s underlying Resource

e. Commercial operation date must be within 5 years of the commercial operation date of the PPA's underlying Resource

14. Updated PPA Resource cost capped by the Reference Resources will be made available to the Filing Entity 8 days prior to the effective month. The selection of the Reference Resources from among the groups of comparable Resources will be based upon monthly averages for fuel price indices and emission credit indices for the first 15 days of the month prior to the effective month.

15. The effective period for the Reference Resources will be the first day of each month through the last day of the same month.

16. Selected Reference Resources by Verifiable cost type will be compared on a monthly basis to PPA Verifiable cost type to determine whether the PPA will be subject to one or more of the caps for the succeeding month. The status of a PPA Verifiable cost type as "capped" or "not capped", as determined monthly, will continue unchanged throughout the succeeding month until determination of Reference Resources and caps has been re-accomplished.

17. For a PPA that has been determined to be capped for the month, the Reference Resource values for fuel volumes, if applicable, and O&M costs (including emission credit costs if applicable) will be substituted for the PPA values for the purpose of calculating cap values. This principle applies both to PPAs with separate values for fuel cost and O&M cost and to PPAs with only one non-differentiated cost shown. For a PPA that has been determined to not be capped for the month, values used to determine payment will be the fuel volumes taken from the underlying Resource and O&M costs taken from the PPA, as described below.

18. The Verifiable Cost values used during the month, for a Resource with a PPA that has furnished approved fuel volume data, will be based upon interval by interval calculations. These calculations will use, for a Resource that:

    a. has been capped for the month:
        i. the underlying Resource fuel volumes,
        ii. the daily Fuel Index Price,
        iii. Reference Resource emission volumes if applicable,
        iv. the monthly average emission credit indices if applicable, and
        v. the Reference Resource O&M costs.

    b. Thus, the fuel part of verifiable costs will vary on a daily basis, but the verifiable costs cap on O&M costs will vary on a monthly basis, and the O&M costs will be equal to the costs calculated for the Reference Resources for the same start-up and LSL operation levels.

    c. has not been capped for the month:
        i. the underlying Resource fuel volumes,
        ii. the daily Fuel Index Price,
        iii. the underlying Resource emission volumes if applicable,
        iv. the monthly average emission credit indices if applicable,
        v. and PPA O&M costs.

d. Thus, the fuel part of verifiable costs will vary on a daily basis, the O&M part of VC will vary on a monthly basis and the O&M costs will not be higher during the month than the verifiable costs that would have been calculated for the Reference Resources for the same start-up and LSL operation levels.

19. In the event that Verifiable Costs for comparable Resources do not exist at the time of the filing of Verifiable Cost documentation for a PPA, ERCOT will use the PPA's underlying Resource actual fuel volumes submitted by the QSE for startup and operation at LSL and the Resource Category Startup Offer Generic Costs as the cap for the O&M portion of the startup costs until ERCOT receives and has approved comparable Resource Specific Verifiable Costs. The Generic cost for operation at LSL includes no O&M cost. Thus, when no Reference Resource is available, zero O&M cost will be added to the fuel cost at LSL.

20. For PPA Resources without a Reference Resource, the Resource Category Startup Offer Generic Costs represents the cost of the Resource for a cold start. Costs for intermediate and hot start costs will bear a relationship to cold start costs of approximately 70% and 50%, respectively, as follows:

    a. Cost of hot start = Cost of cold start x 0.5
    b. Cost of intermediate start = Cost of cold start x 0.7

21. If the Verifiable Cost of a Reference Resource for a PPA changes, the cap for that PPA may also change, on a monthly basis.

22. Only fuel and O&M costs related to Start-Up and operation at LSL will be included in Verifiable Costs for a PPA. If multiple fuels are used for Startup and/or LSL operation, the QSE must provide estimated percentages of each fuel to be used and support such estimates with sufficient data. For the purpose of calculating the reference unit, ERCOT will utilize the higher fuel percentage submitted with VC.

23. If a Resource uses one fuel to start-up and bring the Resource to LSL and a different fuel for continuing operation, the QSE must submit its start-up Verifiable Cost information on the basis of the start-up fuel making it clear in its submission this circumstance. ERCOT will make its Verifiable Cost determinations separately on the basis of the fuel used for start-up fuel and the fuel used for operation at LSL.

24. Recovery of fixed costs as Verifiable Costs is prohibited by the Protocols and therefore not recoverable under this procedure.

25. Recovery of capacity costs under PPAs as Verifiable Costs is prohibited by the Protocols and therefore not recoverable under this procedure.

26. QSEs choosing to submit PPAs and choosing to submit Incremental Heat Rate (IHR) Curves for Real Time Mitigation (above LSL) must calculate these curves from the underlying Resource's actual Input-Output (I/O) equation as set forth in the Verifiable Cost Manual. ERCOT will not accept Heat Rate values as stated in the PPA at face

value unless documentation is submitted showing that the Heat Rate curve is derived from actual data generated from the Resource's operation and that it is consistent with Section 6: Verifiable Heat Rates of the Verifiable Cost Manual.

27. QSEs choosing to submit Variable O&M costs above LSL must submit O&M costs (including the costs of emission credits) of the PPA for operations above LSL but these are capped at the average cost of the Reference Resource.

28. The selection of the Reference Resource for operations above LSL will be done on the basis of the highest simple average ERCOT approved Verifiable O&M Costs, above LSL, for all comparable Resources without a PPA, for that verifiable cost type. The PPA O&M cap will be set equal to the O&M costs of the Reference Resource for the entire PPA Resource IHR range.

29. If energy supplied under a PPA is provided by more than one Resource or by more than one combined cycle train configuration, the QSE must provide Verifiable Cost information for each Resource and configuration.

30. Upon the expiration of a PPA submitted as Verifiable Costs documentation, the Three-Part Supply Offer Cap will be based on Generic cost and will be effective one (1) Calendar Day after the expiration of the PPA, unless the QSE has submitted and ERCOT has approved new Resource-Specific Verifiable Costs prior to the expiration of the PPA, or another PPA replaces the one that expired.

31. The timeline that applies to ERCOT for reviewing PPAs may differ from the timeline for Verifiable Costs submissions without PPAs, depending on the complexity of the PPAs and ERCOT's ability to review the PPAs as rapidly as a Resource Specific submission.

32. ERCOT shall treat all PPAs as Protected Information.

Section 3: Verifiable Startup Costs

This section of ERCOT's Verifiable Cost Manual describes policies and procedures that relate to the submission of Verifiable Startup Costs.

Verifiable Startup Costs Policies

1. The components of startup costs are fuel consumption rates and incremental O&M costs. These are to be derived by applying financial and/or engineering analysis to manufacturer data, operational data, or the results of recent tests on a Resource.

2. Startup fuel consumption rates (MMBtu/start) must be submitted for all startup types (cold, intermediate, and hot) for a Filing Entity to be considered as having submitted Verifiable Startup Costs. However, if a Resource does not have a distinct start type which is analogous to intermediate startup (or if there are no costs specific to an intermediate start), the Filing Entity must assign a value to the intermediate startup costs equal to the hot startup costs.

3. Submitted startup fuel consumption rates and O&M costs will be reviewed by ERCOT and, upon approval, will be used prospectively to calculate Verifiable Startup Costs.

4. The Verifiable Startup Cost ($/start) for a Resource is the verified per-start fuel consumption rate (MMBtu/start)), adjusted by the Proxy Heat Rate (PHR) and value of X (VOX) multiplied by the relevant fuel price ($/MMBtu) plus the verified O&M costs for the Resource. See Appendix 5 for a description of the equation used by ERCOT to calculate Verifiable Startup Cost.

5. Fuel consumed from breaker open to Shutdown may be included as a Verifiable Startup Cost.

Submitting Startup Costs

Verifiable Startup Costs for a Resource represent a proxy for all of the costs incurred in order to bring a Resource online and make it available to produce power. Only the costs incurred from startup through LSL and from breaker open to Shutdown are permissible startup costs.

The nature of the data that a Filing Entity may submit is set forth below and also partially within Section 5 of the Protocols, which defines Verifiable Startup Costs as:

1. Adjusted fuel consumption rate per start (MMBtu/start) multiplied by a resource category generic fuel price (FIP, FOP, or $1.50 per MMBtu, as applicable); and

[VCMRR005: Replace paragraph 1 above with the following upon system implementation of NPRR664:]

1. Adjusted fuel consumption rate per start (MMBtu/start) multiplied by a resource category generic fuel price ($FIPR_r$, FOP, or $1.50 per MMBtu, as applicable); and

2. Unit-specific verifiable operation and maintenance expenses.

Startup Fuel Consumption

Fuel consumed during a startup is defined as the fuel consumed from first fire through LSL plus the fuel consumed from breaker open through Shutdown (Including auxiliary boiler fuel and auxiliary-equipment fuel or electrical power requirements), excluding normal plant heating.

It is expected that the amount of fuel consumed will be different for each of the three start types. If available, historical data must be used to determine the typical amount of fuel consumed per start for each start type. This typical per-start fuel consumption is to be determined in accordance with the following rules:

1. When possible, startup fuel consumption rates are to be based on the amount of fuel a Resource has historically consumed per start.

2. For a Filing Entity that does not submit seasonal data, submitted historical usage data should, for each start type, include fuel consumption rates for the lesser of the last 10 starts or every start within the past three (3) years. For a Filing Entity that submits seasonal data, submitted historical usage data should, for each start type, include fuel consumption rates for the lesser of the last three (3) starts or every start within the past three years for each season. For each start type, the Filing Entity shall submit the historical fuel consumption data, an average amount of historical fuel consumption, and the fuel consumption rate that the Resource believes represents the current startup fuel consumption rate.

3. If a Resource does not have the historical fuel consumption rates for each start described above, the Filing Entity must submit the aforementioned data that it does possess and may also include per-start fuel consumption rates based on manufacturer suggested values or tests which are ERCOT approved.

4. If a Filing Entity submits historical startup fuel consumption data on a per hour basis (MMBtu/hour), it must also provide proof of the average number of hours it requires to reach LSL for each startup type.

5. In its sole discretion, however, ERCOT may choose not to accept the Filing Entity's submitted per-start fuel consumption rates if ERCOT determines that they do not represent a Resource's "true" startup fuel consumption or that they have not been proven in sufficient detail.

6. Historical fuel consumption rates must be based on documented metered reads when available.

Adjustments to Verified Startup Fuel Consumption

Verified Startup Fuel Consumption is subject to two adjustments. The first adjustment is based on a Proxy Heat Rate that approximates Real Time revenues received by Resources while ramping between breaker close and LSL (see Appendices 5, Specification of Relevant Equations, and 6, Calculation and Application of Proxy Heat Rate and the Value of X). The second adjustment is based on a fuel adder (value of X – VOX or actual fuel cost) to account for the difference between spot fuel prices, transportation costs, and FIP as described in Protocol Section 5.6.1.1, Verifiable Startup Costs, and Section 2, General Rules of Verifiable Costs, and Appendix 6 of this Verifiable Cost Manual. The fuel adder adjustment described in Section 2 and Appendix 6 applies to all Resource fuel types, including natural gas, fuel oil and solid fuel generators.

[VCMRR005: Replace the paragraph above with the following upon system implementation of NPRR664:]

Adjustments to Verified Startup Fuel Consumption

Verified Startup Fuel Consumption is subject to two adjustments. The first adjustment is based on a Proxy Heat Rate that approximates Real Time revenues received by Resources while ramping between breaker close and LSL (see Appendices 5, Specification of Relevant Equations, and 6, Calculation and Application of Proxy Heat Rate and the Value of X). The second adjustment is based on a fuel adder (value of X – VOX or actual fuel cost) to account for the difference between spot fuel prices, transportation costs, and $FIPR_r$ as described in Protocol Section 5.6.1.1, Verifiable Startup Costs, and Section 2, General Rules of Verifiable Costs, and Appendix 6 of this Verifiable Cost Manual. The fuel adder adjustment described in Section 2 and Appendix 6 applies to all Resource fuel types, including natural gas, fuel oil and solid fuel generators.

Additional Rules for Submitting Fuel Costs

1. Filing Entities may elect to submit an actual fuel adder ($/MMBtu) for each Resource for verification by ERCOT. For any Filing Entity that submits actual verifiable costs, the fuel adder will default to $0.50/MMBtu until the Filing Entity establishes an actual fuel adder in those verifiable costs and the Filing Entity must continue to provide actual fuel costs as prescribed in paragraph (2) below. The fuel adder is included in the value of X (VOX) as described in Appendix 6, Calculation and Application of Proxy Heat Rate and the Value of X.

2. Any Filing Entity that submits an actual fuel adder, on a seasonal basis, must provide documentation that establishes the historical costs for fuel, including transportation, spot fuel, and any additional verifiable cost associated with fuel contracts that can be easily differentiated from the standard commodity cost of fuel and clearly attributable to the Resource for the period. The fuel adder for a rolling 12-month period is the difference between the Filing Entity's average fuel price paid (including all fees) during the period and FIP. The Filing Entity shall provide rolling 12-month supporting data to verify total fuel price for all purchased volumes to support the actual Resource fuel consumption. Data to support these costs should include, but are not limited to, accounting ledger entries, invoices, and copies of fuel contracts. In addition, the actual costs used to

calculate the fuel adder may include, but are not limited to, the following categories: transportation, deliveries, storage, injection, withdrawal, imbalance, and minimum requirements fees. Other costs not described herein may be included and approved by ERCOT.

[VCMRR005: Replace paragraph 2 above with the following upon system implementation of NPRR664:]

2. Any Filing Entity that submits an actual fuel adder, on a seasonal basis, must provide documentation that establishes the historical costs for fuel, including transportation, spot fuel, and any additional verifiable cost associated with fuel contracts that can be easily differentiated from the standard commodity cost of fuel and clearly attributable to the Resource for the period. The fuel adder for a rolling 12-month period is the difference between the Filing Entity's average fuel price paid (including all fees) during the period and $FIPR_r$. The Filing Entity shall provide rolling 12-month supporting data to verify total fuel price for all purchased volumes to support the actual Resource fuel consumption. Data to support these costs should include, but are not limited to, accounting ledger entries, invoices, and copies of fuel contracts. In addition, the actual costs used to calculate the fuel adder may include, but are not limited to, the following categories: transportation, deliveries, storage, injection, withdrawal, imbalance, and minimum requirements fees. Other costs not described herein may be included and approved by ERCOT.

Note: Review and approval of fuel costs follows the same timeline as verifiable costs; however, ERCOT may require additional time to verify the fuel costs based on the complexity of the submission. In such case, ERCOT will notify the Filing Entity within 15 Business Days of submission if additional time is needed. For clarification on the submission timeline for the seasonal fuel adder, please see the table below. The fuel adder will be implemented the first day of the month after fuel costs have been approved.

	Months of Season	Submission Period	Approval Period
Winter	December – February	April	May-June
Spring	March – May	July	August-September
Summer	June – August	October	November-December
Fall	September- November	January	February-March

Fuel Type Percentages

For each start type, the Filing Entity must provide documentation establishing the respective ratios of gas, oil, and solid fuel consumed during the startup through LSL sequence. Historical and/or manufacturer suggested ratios are to be submitted as percentages and in accordance with the manner of submitting startup fuel consumption data, detailed above. For each start type, the Filing Entity must calculate and submit:

- total fuel consumption per-start (MMBtu/start); and
- the ratio of each type of fuel consumed to the total amount of fuel consumed per startup.

Filing Entities with approved fuel consumption ratios for the associated Resource are to submit updated data to ERCOT if they subsequently use a different fuel type during startup and if they also anticipate doing so for any substantial period of time, whether due to fuel market conditions or otherwise.

Non-Fuel Startup Costs

Verifiable Non-Fuel Startup Costs represent a proxy for all non-fuel costs that a Resource incurs during the startup through LSL and from breaker open to shutdown sequence. The costs that ERCOT considers in calculating this proxy include incremental operation and maintenance costs (Verifiable O&M) that can reasonably be said to result from the Resource starting up. Verifiable O&M Costs include and incremental emission costs applicable to net generation between BC and LSL. For more information see *Section* 2: *General Rules of Verifiable Costs*.

To be included as a Verifiable O&M Cost of Startup, O&M costs must be submitted in accordance with *Section 9: Operating and Maintenance Cost Guidelines.* ERCOT will not approve submitted O&M startup costs if the amounts or the methods used to calculate them do not coincide with other O&M costs a Filing Entity has submitted, unless there is a reasonable, documented reason for doing so. For example, startup operating costs might be different because there are greater chemical, water or emissions costs during the startup sequence. Also, it might be reasonable to multiply an hours-based maintenance cost by the amount of time it takes to complete a startup to LSL sequence. Additionally, if maintenance costs are allocated on a per-start basis, it might be reasonable for the maintenance component of verifiable startup costs to differ per start type.

Start Type Descriptions

The following is a general description of startup costs per start type:

Hot Startup Cost

Hot startup cost is the expected cost to start a Resource, which is in the "hot" condition. Hot conditions vary unit by unit, but in general, a steam unit is hot through an overnight shutdown.

Intermediate Startup Cost

Intermediate startup cost is the expected cost to start a Resource that has recently been online and for which neither hot nor cold conditions are applicable.

Cold Startup Cost

Cold startup cost is the expected cost to start a Resource which is in the "cold" condition. Cold conditions vary unit by unit, but in general, a steam unit is cold after a two or three-day shutdown.

Table 1: Startup Verifiable Cost Data Requirements per Resource per start type

Input Data	Description
AFCRS (MMBtu/Start)	**Fuel consumption rate per start**

GASPERSU (%)	**Gas fuel consumed per start as a percentage of total per start fuel consumption**
OILPERSU (%)	**Oil fuel consumed per start as a percentage of total per start fuel consumption**
SFPERSU (%)	**Solid fuel consumed per start as a percentage of total per start fuel consumption**
O&M ($/start)	**Verifiable O&M expenses per start**

Section 4: Verifiable Minimum Energy Costs

This section of ERCOT's Verifiable Cost Manual describes the policies and procedures that relate to the submission of Verifiable Minimum Energy Costs.

Verifiable Minimum Energy Cost Policies

1. The components of Minimum Energy Costs are fuel consumption rate and incremental O&M costs. These are to be derived by applying financial and/or engineering analysis to manufacturer data, operational data, or the results of recent tests performed on the Resource.

2. Filing Entities must submit the rate at which fuel is consumed during operation at LSL (MMBtu/hour).

3. Filing Entities must submit the LSL level of output (MW) expected during normal operations. This LSL should also represent the LSL a QSE expects to submit in future COPs.

4. If Minimum Energy fuel consumption rates vary by season, Filing Entities must submit such seasonal rates in accordance with the procedure describe herein.

5. Submitted minimum energy fuel consumption rates and O&M costs will be reviewed by ERCOT and, upon approval, will be used prospectively to calculate Verifiable Minimum Energy Costs.

6. The Verifiable Minimum Energy Cost ($/MWh) for a Resource is the verified adjusted by VOX fuel consumption rate at LSL (MMBtu/hr) divided by the Resource's LSL (MW), multiplied by the relevant fuel price ($/MMBtu), plus the verified O&M ($/MWh) at LSL for the Resource. See Appendix 5 for a description of the equation ERCOT will use to calculate Verifiable Minimum Energy Cost.

Submitting Minimum Energy Costs

Verifiable Minimum Energy Costs are the verifiable costs a Generation Resource incurs while operating at the LSL. The nature of the data that Filing Entity may submit is set forth below and within Section 5 of the Protocols, which defines Verifiable Minimum Costs as:

1) The unit-specific verifiable minimum-energy costs for a Resource are:

   (a) Actual fuel cost to operate the unit at LSL; and

   (b) Variable operation and maintenance expenses.

Minimum Energy Fuel

Minimum Energy Fuel is defined as fuel consumed by a Resource while operating at the Low Sustained Limit**,** including auxiliary equipment fuel or electrical power requirements but excluding normal plant heating. Minimum Energy Fuel is to be determined in accordance with the following:

1. Filing Entities must submit resource-specific Input-Output (I/O) curves (MMBtu/Hr), including their corresponding equation coefficients, for the period from which their verifiable cost data was derived. ERCOT will calculate Average Heat Rate Curves utilizing these I/O equations. If fuel consumption at LSL varies by season, Filing Entities must submit seasonal I/O curves. More information on heat rates is provided below in *Section 6: Verifiable Heat Rates*.

2. If available, submitted historical usage data should include fuel consumption rates for the last 25 periods a Resource operated at the LSL.

3. If a Resource does not have the historical fuel consumption rates for all of the deployments described above, the Filing Entity must submit the aforementioned data that it does possess and may also include a fuel consumption rate at LSL (MMBtu/hour) based on manufacturer suggested values or actual tests which are ERCOT approved.

4. In its sole discretion, however, ERCOT may choose not to accept the Resource's fuel consumption rate at LSL submitted by the Filing Entity if ERCOT determines that it does not represent a Resource's "true" fuel consumption at LSL or that it has not been proven in sufficient detail.

Fuel Type Percentages at LSL

Filing Entities must provide documentation establishing the respective ratios of gas, oil, and solid fuel consumed during operation at the Low Sustained Limit. Historical and/or manufacturer suggested ratios are to be submitted as percentages and in accordance with the manner of submitting minimum energy fuel consumption data, detailed above.

Non-Fuel Minimum Energy Cost

Verifiable Non-Fuel Minimum Energy Costs represent a proxy for all non-fuel costs that a Resource incurs while operating at LSL. These costs need to be submitted in terms of $/MWh. ERCOT will not approve fixed costs or capital costs of any type nor insufficiently documented costs. The costs that ERCOT considers in calculating this proxy are limited to incremental operation and maintenance costs (Verifiable O&M) that can reasonably be said to result from operation at LSL.

Verifiable Non-fuel Minimum Energy O&M Costs are defined to include incremental emission costs, for more information see *Section* 2: *General Rules of Verifiable Costs*.

Verifiable Operation Minimum Energy Costs

To be included as a Verifiable Minimum Energy Cost, operating costs must be submitted in accordance with *Section 8: Operating and Maintenance Cost Guidelines*. Emission costs may be included as a cost of operating a generator at minimum energy. ERCOT will not approve

submissions for the operating cost component of Verifiable Minimum Energy Costs if the amounts or the method used to calculate them do not coincide with other Verifiable Operating Costs a Filing Entity has submitted, unless there is a reasonable, documented reason for doing so.

Verifiable Maintenance Minimum Energy Costs

To be included as a Verifiable Minimum Energy Costs, maintenance costs may be submitted in accordance with *Section 8: Operating and Maintenance Cost Guidelines*. ERCOT will not approve submissions for the maintenance cost component of Verifiable Minimum Energy Costs if the amounts or the method used to calculate them do not coincide with other Verifiable Maintenance Costs a Filing Entity has submitted, unless there is a reasonable, documented reason for doing so.

Table 2: Minimum Energy Cost Data Requirements per Resource

Input Data	Description
VFCLSL (MMBtu/MWh)	**Adjusted verified fuel consumption at LSL**
GASPERME (%)	**Gas fuel consumed during operation at LSL as a percentage of total LSL fuel consumption**
OILPERME (%)	**Oil fuel consumed during operation at LSL as a percentage of total LSL fuel consumption**
SFPERME (%)	**Solid fuel consumed during operation at LSL as a percentage of total LSL fuel consumption**
LSL (MW)	**Low Sustained Limit Output**
VOMLSL ($/MWh)	**Variable O&M expenses at LSL**

Section 5: Mitigated Offers and Verifiable Costs

This section of ERCOT's Verifiable Cost Manual pertains to the use of Verifiable Costs for the purpose of calculating Mitigated Offer Caps (MOC). It describes the policies and procedures relating to the submission of Verifiable Incremental Heat Rate and Variable O&M data.

Submitting Data for Mitigated Offers

Filing Entities may submit two types of resource-specific Verifiable Cost data for inclusion in the calculation of Mitigated Offer Caps: Verifiable O&M data and Verifiable Incremental Heat Rate ("IHR") data. Submission of this data, for use in calculating Mitigated Offer Caps, is optional, except for Resources under a Reliability-Must-Run (RMR) contract which must submit to ERCOT an Incremental Heat Rate Curve calculated in a manner as described in *Section 6: Verifiable Heat Rates* of this Manual. A Filing Entity that submits Variable O&M Cost data for use in calculating Mitigated Offers must also submit IHR Curve data. However, a Filing Entity may submit IHR Curve data without submitting corresponding VOM data. To be verified by ERCOT, submitted data must also comply with the relevant requirements set forth below.

Variable O&M

For purposes of calculating Mitigated Offer Caps, Variable O&M costs are limited to the incremental O&M costs a Resource incurs while operating above LSL. Variable O&M costs will only be verified if both the type of cost and its method of calculation are permissible under *Section 8: Operating and Maintenance Cost Guidelines* of this document. Submitted data is to be in terms of dollars per Megawatt-hour ($/MWh) and must be a single average value for the entire range (LSL to HSL) of the IHR Curve submitted. Emission costs may be included as an additional component of the Variable O&M cost. For more information see *Section* 2: *General Rules of Verifiable Costs*.

Fuel Type Percentages above LSL

Filing Entities that submit Incremental Heat Rates must also provide documentation establishing the ratios of gas, oil, and solid fuel that is consumed during operation above LSL. The same ratios will apply to all output levels between LSL (or LEL) and HSL (or HEL).

Verifiable IHR

If a Filing Entity submits Verifiable Variable O&M costs, the Filing Entity must also submit Verifiable IHR Curves in accordance with *Section 6: Verifiable Heat Rates* to complete the submission of Verifiable Costs for Mitigated Offer Caps. Additionally, submitted IHR Curve data must be calculated directly from the I/O equation, as described in that same section. IHR Curve data must:

1. Consist of at least 2, but no more than 10, pairs of MMBtu/MWh and MW points; and
2. Include the B, C and D coefficients calculated from the I/O equation (i.e., $I/O = A + Bx + Cx^2 + Dx^3$).

Table 3: Real Time Mitigation Data

Input Data	Description
Incremental Heat Rate Data Points (MMBtu/MWh, MW)	**Points along the Incremental Heat Rate Curve – Up to 10 pairs**
VOM ($/MWh)	**Variable O&M expenses above LSL; one average value along the entire IHR Curve**
GASPEROL (%)	**Gas fuel consumed during operation over LSL as a percentage**
OILPEROL (%)	**Oil fuel consumed during operation over LSL as a percentage**
SFPEROL (%)	**Solid fuel consumed during operation over LSL as a percentage**

Section 6: Verifiable Heat Rates

This section of ERCOT's Verifiable Cost Manual describes the policies and procedures for submitting Heat Rate information.

Verifiable Heat Rate Policies

Heat rate curve data is utilized within the Nodal Verifiable Cost Process because it can be used, in conjunction with the market price of fuel, to provide a proxy for the actual fuel costs of operating a Resource.

In the ERCOT Nodal market, there are two types of Resource-specific Heat Rate Curve data that Filing Entities may submit: Incremental Heat Rate and Average Heat Rate data. Average Heat Rate data must be submitted with Verifiable Minimum Energy Cost submissions. Incremental Heat Rate data may be included with data submitted for use in calculating Mitigated Offer Caps. ERCOT, however, will not approve any submitted heat rate data unless the Filing Entity also develops and submits Resource-specific heat-input versus power-output curves ("I/O Curves"). That is because ERCOT uses I/O Curves as a basis for verifying heat rate curves.

The first of the aforementioned curves, the Incremental Heat Rate ("IHR") Curve, is defined as the first derivative of the I/O Curve. It provides the amount of thermal energy used by a Resource to achieve an incremental change in electrical energy output (i.e., the amount of thermal energy used to produce an additional unit of output). The second, the Average Heat Rate ("AHR") Curve provides the average amount of energy used by a Resource to provide each unit of power output. The AHR Curve is determined by dividing input in fuel by the power it generates for various levels of generation.

Submission of Heat Rate Curve Data

All Heat Rate Curves and Heat Rate data must be submitted in terms of Net Output. Filing Entities have two options for submitting Heat Rate Curves and Heat Rate data: submit the results of tests actually performed on the generating unit or submit the manufacturer suggested Heat Rate values. If a Filing Entity has reason to believe that the physical characteristics of a generator have changed so that previously submitted Heat Rate Curves overstate fuel consumption or under state efficiency, the Filing Entity must notify ERCOT and must submit updated Heat Rate data.
Finally, submitted data relating to these curves must comply with the relevant requirements set forth below in order to be approved by ERCOT.

Input-Output Curve

For each Resource for which Heat Rate Curve data are submitted, the Filing Entity shall submit to ERCOT the I/O Curve in accordance with the following:

1. Resource total heat (or fuel) I/O curves based on design or data from comparable units, modified by available actual unit test data

2. The actual data for the total heat (or fuel) I/O curve must include minimum and maximum load points and at least two intermediate load points
3. I/O curves are to be fitted from data using either manual or computer techniques
4. Submitted I/O Curves are to be defined by the third-order equation: $y = A + Bx + Cx^2 + Dx^3$
    - Where: x = Output in MW; y = Input in MMBtu/hr; and A-D = coefficients that define the equation
    - All values (y, x, A, B, C, D) must be provided to ERCOT
    - All coefficients (A, B, C, D) must be nonzero.

5. If during the construction of the I/O Curve a Resource believes the Second-Order equation (i.e. d = 0) better defines the curve for this specific Resource, the Filing Entity must submit to ERCOT a written explanation detailing the reason and process used to create such a curve.
6. In its sole discretion, however, ERCOT may choose not to accept a Filing Entity's submitted I/O equation if ERCOT determines that it does not represent a Resource's "true" heat rate curve or if the curve has not been proven in sufficient detail.

ERCOT will verify this I/O Curve and will use it a basis for verifying the IHR and AHR Curves.

Incremental Heat Rate Curve

All submitted IHR Curve data must:

1. be determined, either mathematically, or directly from the relevant Resource's I/O Curve;
2. provide a monotonic, non-decreasing function;
3. be submitted in terms of MMBtu/MWh;
4. consist of at least 2, but no more than 10, pairs of IHR (MMBtu/MWh) and Output (MW) points; and
5. be defined as the I/O Curve's first derivative: $IHR = dy/dx = B + 2Cx + 3Dx^2$, *unless it's based on a second order equation as described in (5) above.*
    a. Where: x = Output in MW; y = Input in MMBtu/MWh; and B-D = coefficients that define the equation

    All values (dy/dx, x, B, C, D) must be provided to ERCOT

If a generator does not have a monotonic and non-decreasing IHR, a Filing Entity must instead submit both of the following:

1. their actual IHR curve (without modifications); and may submit
2. a representative monotonic, non-decreasing curve that has been derived from the actual IHR. This representative curve is subject to the above paragraph.

If a generator includes an IHR curve for the unit's power augmentation MW levels, it must meet the same guidelines as described herein.

Average Heat Rate Curve

All submitted AHR Curve data must:

1. be determined, either mathematically or graphically, directly from the relevant Resource's I/O Curve;
2. be submitted in terms of MMBtu/MWh;
3. and Output (MW) points; and
4. be defined as the I/O Curve divided by the output (x): $AHR = y/x = (A + Bx + Cx^2 + Dx^3) / x$
   a. Where: x = Output in MW; y = Input in MMBtu/MWh; and A-D = coefficients that define the equation
   b. All values (y/x, x, A, B, C, D) must be provided to ERCOT

Section 7: Verifiable Fuel Costs

Verification for Real-Time Make-Whole Payments for Exceptional Fuel Costs

For Generation Resources to recover actual costs paid for fuel, per Protocol Section 6.6.3.7, Real-Time Make-Whole Payment for Exceptional Fuel Cost, the actual cost paid for physical delivered fuel must be greater than the fuel price used by ERCOT for the Resource plus the fuel adder plus a threshold fuel price. The threshold fuel price is set at $2.00/MMBtu. QSEs that file a fuel dispute must provide supporting documentation that identifies the cost of fuel consumed during the Settlement Intervals where the Resource was dispatched on its Mitigated Offer Curve. Documentation to justify recovery of fuel costs must be limited to the actual fuel quantity (MMBtus) consumed during the mitigated intervals. All documentation submitted by the QSE for fuel costs incurred must show a nexus from the seller or distributor of fuel products to the QSE, Resource Entity or Generation Entity as the ultimate buyer. The QSE must demonstrate that the seller or distributor has procured and delivered fuel. Power Purchase or Tolling Agreements (PPAs) filed as documentation of proof of fuel costs will not be accepted unless it meets the criteria in paragraph (4)(b) of Protocol Section 9.14.7, Disputes for RUC Make-Whole Payment for Exceptional Fuel Costs.

Verification for Natural Gas:

For natural gas, the QSE representing the Resource must provide documentation (invoices, transaction confirmations, etc.) that identifies the delivered cost of spot natural gas consumed during the mitigated intervals. Spot natural gas includes the following gas purchases only:

- Natural gas purchased during normal daily gas trading for next-day flow up to and including the next trading day ("day-ahead" gas). Day-ahead gas transactions are typically included in the determination of daily gas price indices, such as Platt's Gas Daily indices.
- Natural gas purchased after normal daily trading for flow on the current gas day up to and including the next gas trading day ("intra-day" or "same-day" gas).
- Natural gas purchased under contracts for longer periods where the price for daily gas deliveries are based on a daily gas price index (or daily gas price indices) effective for gas flows on such day.

Verification for Fuel Oil:

For fuel oil, the QSE representing the Resource must provide documentation that identifies the replacement cost of the fuel oil consumed during the mitigated intervals. In addition, the QSE representing the Resource must provide documentation indicating the purchase of the replacement fuel oil within 20 days from the time the Resource was mitigated.

[VCMRR005: Delete Section 7 above effective May 1, 2015:]

[VCMRR005: Replace Section 7 above with the following upon system implementation of NPRR664:]

Section 7: Verifiable Fuel Costs

Verification for Real-Time Make-Whole Payments for Exceptional Fuel Costs

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For natural gas, the QSE representing the Resource must provide documentation (invoices, transaction confirmations, etc.) that identifies the delivered cost of spot natural gas consumed during the mitigated intervals. Spot natural gas includes the following gas purchases only:

- Natural gas purchased during normal daily gas trading for next-day flow up to and including the next trading day (“day-ahead” gas). Day-ahead gas transactions are typically included in the determination of daily gas price indices, such as Platt’s Gas Daily indices.
- Natural gas purchased after normal daily trading for flow on the current gas day up to and including the next gas trading day (“intra-day” or “same-day” gas).
- Natural gas purchased under contracts for longer periods where the price for daily gas deliveries are based on a daily gas price index (or daily gas price indices) effective for gas flows on such day.

Verification for Fuel Oil:

For fuel oil, the QSE representing the Resource must provide documentation that identifies the replacement cost of the fuel oil consumed during the mitigated intervals. In addition, the QSE representing the Resource must provide documentation indicating the purchase of the replacement fuel oil within 20 days from the time the Resource was mitigated.

Designation of the Fuel Index Price for Resource ($FIPR_r$)

Generation Resources can designate whether they purchase natural gas at FIP, Waha, or utilize a combination of both indices. If a Resource does not designate a Fuel Index Price for Resource ($FIPR_r$), the $FIPR_r$ will default to FIP. For Resources that designate both indices, the $FIPR_r$ will be calculated as follows:

$FIPR_r$ = (FIP *FIPFactor) + (WFP* WahaFactor)

Where:

FIPFactor = FIPQ/TotalQ

WahaFactor= WahaQ/TotalQ

TotalQ= FIPQ+WahaQ

And:

$FIPR_r$ = Fuel Index Price for Resource for the Operating Day

FIP = Fuel Index Price as defined in Protocol Section 2, Definitions and Acronyms

WFP= Waha Fuel Price for the Operating Day

FIPQ= quantity of fuel purchased at FIP

WahaQ = quantity of fuel purchased from Waha for the period

TotalQ = total fuel purchased for the period from both indices

The FIP and Waha factors will be calculated on an annual basis. If a Resource has designated Waha or a combination of both indices for its $FIPR_r$, supporting documentation will need to be submitted to and verified by ERCOT[1]. The supporting documentation will need to verify total fuel volumes purchased for the period from each index. Data to support these costs should include, but are not limited to, accounting ledger entries, invoices, and copies of fuel contracts. All documentation must be based on physical rather than financial transactions.

[1] Resources that solely utilize FIP do not need to notify ERCOT and will not need to provide supporting documentation.

Section 8: Forced Outages and Cancellation of a RUC-Committed Resource

Section A: Forced Outages of a RUC-Committed Resource

This section of ERCOT's Verifiable Cost Manual describes the policies and procedures for submitting *Event Specific Verifiable Cost* data relating to a Forced Outage of a RUC Committed Resource.

Policy for Costs Resulting from a Forced Outage

Pursuant to Section 5.6 of the Protocols, if, before reaching breaker close, a RUC-committed Resource experiences a Forced Outage resulting from startup failure, ERCOT shall include the Resource's *Event Specific Verifiable Costs* in the QSE's RUC Guarantee, limited to the lesser of:

1. Costs that qualify as normal startup expenses, including fuel and operation and maintenance expenses, incurred before the event that caused the Forced Outage; and

2. The respective QSE's Startup Offer in the RUC.

Submission of Forced Outage Cost Data

For purposes of calculating *Event Specific Verifiable Costs* resulting from the Forced Outage of a RUC committed Resource, a QSE may submit the actual costs it incurred as an unavoidable and direct result of the forced outage. All submitted costs must be sufficiently documented so as to allow ERCOT to verify them. Only actual, incremental costs relevant to the startup attempt will be approved. Fixed costs will not be accepted.

In addition to the above restrictions, fuel and O&M costs are subject to the following:

1. QSEs should submit O&M costs in terms of dollars for the attempted start ($/attempted start). These O&M costs must be calculated using the methodology described in *Section 8: Maintenance and Operations Cost Guidelines*, but only actual, documented costs relevant to the start-up attempt should be submitted.

2. QSEs may submit the amount of fuel actually consumed for the attempted start (MMBtu/attempted start).

3. The ERCOT Settlement and Billing system will not automatically calculate a payment to a QSE representing a Resource that experiences a failed startup attempt. QSEs representing a Resource that experienced a failed start-up attempt must submit a settlement dispute in accordance with the dispute process outlined in *Section 9.14 Settlement and Billing Dispute Process* of the Nodal Protocols in order to receive

payment. In addition to the standard information required by the dispute form located on the ERCOT Market Information System (MIS), the dispute should clearly indicate:

a. The Dispatch Instruction associated with the Forced Outage;

b. The total *Event Specific Verifiable Costs* of attempting to provide the service; and

c. A description of the supporting documentation to be subsequently provided to ERCOT

A QSE seeking to have additional Forced Outage costs, which are not specifically discussed in this section, included in their RUC Guarantee must seek to have them approved by the ERCOT Board of Directors during an Executive Session at the next regularly scheduled meeting. Requests must be presented to the Board in person by a representative of the company that incurred the costs. Should the Board approve the inclusion of such costs in the RUC Guarantee, the submitting company must draft and submit a Nodal Protocol Revision Request (NPRR), in accordance with Protocol Section 21, Process for Protocol Revision. Therefore, to ensure subsequent NPRRs accurately capture what the Board did (and did not) approve and clearly provide what is required of similar cost submissions in the future, initial requests to the Board of Directors must include a typewritten statement of the lobbying company's position. This statement must:

1. Define all additional costs sought and do so in a manner that is not specific to the lobbying company (e.g., "insurance deductibles"); and
2. Describe the documentation necessary to establish the accrual of such costs.

Section B: Cancellation of a RUC-Committed Resource

Description

A Reliability Unit Commitment (RUC)-committed Resource that receives a RUC Cancellation prior to breaker close may submit through the dispute process all incremental expenses associated with the RUC Cancellation of the RUC-committed Resource. For additional information, refer to Nodal Protocol Section 5.6.4, Cancellation of a RUC Commitment.

Procedure

Resources may submit a dispute to ERCOT and are required to provide sufficient documentation that demonstrates costs incurred for normal Startup Costs, Operations and Maintenance (O&M) Expenses and associated fuel expenses for that particular event. The cost categories must meet the following Verifiable Cost guidelines:

a. Normal Startup Costs and fuel: Verifiable Cost Manual Section 3, Verifiable Startup Costs
b. O&M Expenses: Verifiable Cost Manual Section 8, Operating and Maintenance Cost Guidelines

Refer to paragraph (4) of Nodal Protocol Section 5.7.3, Payment When ERCOT Decommits a QSE-Committed Resource, for additional information on the calculation of payment.

Section 9: Operating and Maintenance Cost Guidelines

This section of ERCOT's Verifiable Cost Manual describes the policies and procedures relating to the submission of Operating and Maintenance Costs.

Operating and Maintenance Cost Policies

Manuals drafted by the manufacturer of a generating unit and that relate to O&M should be submitted to ERCOT if a Filing Entity submits O&M cost data for use in the Verifiable Cost process. These manuals are necessary for ERCOT to analyze such data.

Verifiable Operating Costs

Operating costs are the non-fuel costs incurred while a Resource is operated, whether incurred during startup or at different output levels. These costs may include, for example, labor costs, the cost of consumables and non-durable goods, costs related to emissions, water costs, etc.

ERCOT will only approve operating costs that are incremental costs; fixed operating costs will be rejected. Additionally, ERCOT will only approve submitted operating costs to the extent that they reasonably represent the incremental operating costs at the stage of the power generation cycle for which they are submitted (startup, operation at LSL, or operation above LSL). For example, ERCOT might approve the wages paid to on-call, hourly employees that are needed to help start a Resource. On the other hand, ERCOT would not approve labor costs that are incurred regardless of an incremental deployment (such as those associated with salaried, on-call employees). The reasonableness of an allocation is highly dependent on individual circumstances; thus, ERCOT will make this determination on a case-by-case basis. In making this determination, ERCOT will consider factors such as whether a Resource's operating costs relate to starting the unit or running at different operating levels, follow industry standards, and coincide with manufacturer expectations.

Verifiable Maintenance Costs

Maintenance costs are those costs associated with the maintenance, repair, inspection, and upkeep of generation resources, as well as their parts and equipment. Maintenance costs will only be approved to the extent that they represent the maintenance costs resulting from an incremental period of usage.

Verifiable Maintenance Costs are a proportionate share of future maintenance costs; the allocation of maintenance costs not yet borne must be based upon Resource usage that is reasonably anticipated to occur during the interim. For example, maintenance expenses might be allocated using hours-based, starts-based, or equivalent-operating-hours criteria

In considering whether or not to approve submitted maintenance costs, ERCOT will consider factors such as whether the costs and frequency of maintenance anticipated by a Resource coincides with manufacturer expectations; whether the starts and usage anticipated by a resource is practical, or is likely given the type of generator and general market conditions, or coincides with historical data; etc. Prospective opportunity costs, such as the loss of generating capacity during maintenance, are not verifiable and, therefore, will not be approved by ERCOT.

Event Specific Verifiable O&M Costs

Event Specific Verifiable O&M Costs are limited to provable O&M costs that are actually incurred as a direct result of the specific events detailed in *Section 8: Forced Outage of a RUC-Committed Resource*.

O&M costs incurred during this event (to the extent they exceed O&M costs incurred during any similar, normal operations) must not be incorporated when Resources calculate their incremental Verifiable O&M Costs. Because these added O&M costs are incurred as a result of anomalous and infrequent events; it is improper to include them when allocating O&M costs to incremental generation. QSEs, however, may submit *Event Specific Verifiable O&M Costs* by following the dispute process outlined in *Section 9.14 Settlement and Billing Dispute Process* in the Nodal Protocols.

Options for Submitting Verifiable O&M Costs

Filing Entities may submit Verifiable O&M Costs (but neither *Event Specific Verifiable O&M Costs* nor Fuel Costs) using either of the following two methods:

Option 1: Submission of O&M costs with Documentation and Calculated Using a Resource Specific Methodology

1. Filing Entities must submit the O&M costs of starting up ($/start) for each start type, cold, hot and intermediate, calculated according to a specific methodology that the Resource previously requested and which ERCOT approved.

2. Filing Entities must submit the O&M costs of operating at LSL ($/MWh) calculated according to a specific methodology that the Resource previously requested and which ERCOT approved.

3. Filing Entities may submit the O&M costs of operating above LSL ($/MWh) calculated according to a specific methodology that the Resource previously requested and which ERCOT approved.

4. The amounts and methods used to calculate both the operation and maintenance components of Verifiable O&M Costs must be clearly detailed.

5. Any methodology must meet the guidelines of ERCOT's Verifiable Cost Manual.

6. ERCOT may rescind its prior approval of Verifiable Costs submitted under this Option at any time, but it must have a material, factual basis for doing so. For example, ERCOT may rescind its approval if it subsequently determines the Resource-specific method of calculating O&M was inherently flawed.

Option 2: Submission of O&M costs with Documentation and Calculated Using the Methodology Described in Appendix 1

1. Filing Entities must submit O&M costs that result from starting for each type, cold, hot and intermediate ($/start).

2. Filing Entities must submit O&M costs that result from operation at the LSL ($/MWh).

3. Filing Entities may submit O&M costs that result from operation above LSL ($/MWh).

4. Filing Entities must submit a detailed account of the amounts used to calculate these costs and the manner in which they applied the methodology set forth in Appendix1.

5. ERCOT may rescind its prior approval of Verifiable Costs submitted under this Option at any time, but it must have a material, factual basis for doing so. For example, ERCOT would rescind its approval of part (or all) of the labor costs associated with a scheduled outage upon learning that some (or all) of the workers were salaried.

Additional Conditions Applicable to Option 1 and Option 2

O&M Costs submitted to ERCOT under either Option 1 or Option 2 above are subject to additional conditions, as set for below.

Conditions Applicable to All Types of Resources

1. All O&M costs must be incremental; that is, they may not include fixed or capital costs.

2. Submitted O&M documentation must be Resource specific. Exceptions may be granted for Combined-Cycled Resources on a case-by-case basis.

3. O&M costs must not include fuel costs.

4. Both individual component costs and the final aggregated O&M values must be clearly detailed and shown as $/start or $/MWh, as applicable.

5. Maintenance costs are to be calculated taking into account all available maintenance history (limited by the number of years in a maintenance period where applicable) regardless of unit ownership.

6. Filing Entities must submit operating costs (including water, chemical, emission credits, consumables, etc) per-start ($/start) and per hour of operation at LSL ($/MWh).

7. Filing Entities that include water consumption as part of their operating costs must include documentation indicating the number of gallons used and the output level and duration of operation during which the water was used. The price(s) paid for water ($/gal) must also be documented and submitted.

8. Filing Entities including emission credits as part of their operating costs must provide ERCOT a description of the credits and the methodology used to allocate their costs to O&M.

9. All consumables included in O&M must be clearly documented and include both the quantities used and prices paid.

10. Filing Entities must provide a description of all components included as operating costs and the reason for their inclusion.

11. If a Filing Entity feels that a unit modification or required change in operating procedures will affect the unit's maintenance cost, revised maintenance costs must be submitted to ERCOT for approval.

12. A Filing Entity may submit only one value ($/MWh) for the O&M cost of operation at LSL.

13. A Filing Entity may submit only one single average value ($/MWh) for the O&M cost of operation above LSL.

14. A Filing Entity with a currently effective Long Term Service Agreement Contract (LTSA) for the overhaul and maintenance work on a Resource or specific components of a Resource may include the costs described within that LTSA as Verifiable O&M costs if the following conditions are met:

    a. The maintenance costs to be included are incremental costs and are otherwise consistent with the definitions and uses of those costs within this Manual.

    b. A dollar value for each component of the variable maintenance costs is specifically set by the LTSA.

    c. Cost curves showing variable O&M values versus time are submitted.

    d. ERCOT can verify the incremental or variable maintenance costs ($/MWh) or ($/start) in the LTSA.

    e. LTSA contracts must be submitted directly to ERCOT for review and approval and must be currently effective.

Conditions Applicable to Combustion Turbines

1. The Maintenance Cost component of starting a Combustion Turbine Resource ($/start) or operating at or above LSL ($/MWh) may be calculated and applied on a "per equivalent service hour" (ESH) basis as described in Appendix 1B. If this option is chosen, the calculation can be based on maintenance expenses in a Maintenance Period chosen by the Resource.

2. Resources that determine their costs on an ESH basis may use either the methodology described below in Appendix 1B or another methodology approved by ERCOT to determine their ESH values.

3. The maintenance cost component for a given period must be stated as the total dollars spent per period.

4. Filing Entities must submit the total number of running hours during the maintenance period.

5. Filing Entities must submit the total number of starts during the maintenance period.

6. Filing Entities must submit the average time in hours spent starting up, shown per start type if possible, in the maintenance period.

7. A Filing Entity may include manufacturer recommended values in ESH calculations, if approved by ERCOT in advance.

8. Filing Entities must calculate the maintenance costs per hour of operation in the maintenance period ($/hr) as the total maintenance cost divided by the ESH, unless ERCOT approves another methodology in advance.

9. Filing Entities must calculate the maintenance cost ($/hour) times the average length of start in hours to arrive at an average maintenance cost per start ($/start).

10. Filing Entities must divide the calculated maintenance cost ($/hour) by the LSL (MW) to determine the average maintenance cost per hour of operation at LSL.

11. All O&M costs calculated using equivalent service hours (ESH) must clearly show how the ESH are calculated.

Conditions Applicable to Fossil Thermal Resources

1. Filing Entities must submit the methodology that was used to determine their O&M costs ($/start or $/MWh) for a maintenance period using either a Resource-specific methodology or the one described in Appendix 1A.

2. Any methodology used to determine O&M costs ($/start or $/MWh) for the maintenance period should also describe the costs on a $/MMBtu basis.

Maintenance Period Conditions

When calculating maintenance costs, a 10-year historical period should be used with the exception of Resources with Long-Term Service Agreements. Resources with a Long-Term Service Agreement may submit their maintenance costs based on projected amounts for the components covered by the LTSA. If data are not available for the previous 10 years, then the length of the maintenance period is the length of time for which the data are available. Filing Entities may determine maintenance costs on an annual basis and then normalize them for the entire 10 year (or less) maintenance period. In addition, Filing Entities must utilize the Cost Escalation Factors derived by ERCOT, *see* Figure 2 below, to escalate historical maintenance costs to present value.

ERCOT will assess all submitted O&M costs for reasonability. When making this assessment for submissions with a maintenance period less than 10 years, ERCOT will consider Original Equipment Manufacturers (OEM) recommendations and similar Resources' costs.

Procedure for Establishing Verifiable O&M Costs when insufficient historical data are available

If the Resource (herein referred to as Target Resource) was **acquired-used** within the last two years from the date the Resource Entity (RE) either chose to file verifiable costs or was required per the Nodal Protocols, and the RE does not have sufficient historical costs to create the verifiable cost data points and is not able to develop a methodology acceptable to ERCOT to represent its verifiable cost, then the only available option for the RE is to accept generic costs, which may not be sufficient to cover its variable O&M costs. The Wholesale Market Subcommittee has approved a procedure to establish verifiable O&M costs to replace generic costs when the Target Resource does not have sufficient O&M history.

The procedure is as follows:

1. ERCOT will determine on a monthly basis a list of Equivalent Resources (ER) to serve as a proxy for Target Resources with no O&M cost history.

2. Equivalent Resources will be chosen from the list of

   Resources for which Verifiable Costs have been approved and which meet all of the following criteria:

   i. Same Resource Technology

   ii. Same Primary fuel type

   iii. High Sustained Limit of the ER must be within plus or minus 30% of the HSL of the Resource for which O&M data are required.

   iv. Commercial operation date (COD) of the ER must be within 5 years of the COD of the Resource for which O&M data are required.

3. The O&M cost of Target Resource will be set equal to the average O&M cost of all ERs that match the requirements described in 2 above.

4. O&M costs for ERs will not contain the cost of emissions; however, the Target Resource may submit its actual emission rates to include the emissions costs with their approved O&M values.

5. O&M costs for ERs will be determined separately for each of the Start types: Cold, Intermediate and Hot and for costs at Minimum Energy.

6. Target Resources who choose or are required to submit verifiable costs must file to ERCOT updated actual costs on an annual basis for the following two years after the initial assignment of costs as described in (3) above. Updates must be based on actual O&M cost incurred the previous calendar year. ERCOT will utilize these updates to ensure that the previously approved costs are still valid. If the Filing Entity fails to update costs annually, the Target Resource's cost will be set to generic.

7. After a period of two years and two months ERCOT will "uncap" the Target Resource and approve the O&M based on actual documented costs filed the previous two years. If the Filing Entity has not submitted updated costs and received approval by the end of the two years and two months term, all cost will be generic.

8. The Filing Entity must provide to ERCOT the following information in addition to the other filing requirements defined in the Verifiable Cost Manual:

    1. The date of commercial operation of the Target Resource, and

    2. The previous owner O&M costs recommendations if available to the Filing Entity.

9. ERCOT will notify the Filing Entity of the costs assigned to the Target Resource within three (3) Business Days of the ERCOT's determination and approval by the Filing Entity. If the Filing Entity does not approve the costs assigned to the Target Resource, the costs will be set to generic.

10. Equivalent Resources will be calculated monthly within the first five (5) Business Days of each month.

11. In the event that Verifiable Costs for ERs do not exist, ERCOT will use the underlying Resource actual fuel volumes submitted by the Filing Entity for startup and operation at LSL and the Resource Category Startup Offer Generic Costs as the cap for the O&M portion of the startup costs until ERCOT receives and has approved ER specific Verifiable Costs. The generic cost for operation at LSL does not include O&M cost, therefore, when no ERs are available, zero O&M cost will be added to the fuel cost at Minimum Energy.

12. For Target Resources without ERs the Resource Category Startup Offer Generic Costs represents the cost of the Resource for a cold start. For non-aircraft derivative turbines, costs for intermediate and hot start costs will bear a relationship to cold start costs of approximately 70% and 50%, respectively, as follows:

    1. Cost of hot start = Cost of cold start x 0.5

    2. Cost of intermediate start = Cost of cold start x 0.7

Operating and Maintenance Cost Submissions Types

Appendix 4: Operating and Maintenance Cost Categories provides a list of the types of O&M costs that Filing Entities may use when calculating O&M data.

Section 10: Timelines Applicable to the Submission and Review of Verifiable Costs

This is the section of ERCOT's Verifiable Cost Manual that details the processes and procedures that apply to the submission and approval of Verifiable Costs.

Submission and Approval of Verifiable Cost Data

A Filing Entity initiates the Verifiable Cost Process by submitting their costs to ERCOT in a manner to be determined. In the Nodal market, Verifiable Costs take effect three (3) Business Days after the day they are approved by ERCOT. They will only be used prospectively.

A separate process applies to the submission of *Event Specific Verifiable Costs*, which must be submitted in accordance with the dispute process outlined in *Section 9.14, Settlement and Billing Dispute Process* of the Nodal Protocols. *Event Specific Verifiable Costs* take effect upon approval. They will be applied retroactively and will be used to resettle the Operating Day on which the costs were incurred. Furthermore, *Event Specific Verifiable Costs* are only valid for the specific event for which they are initially submitted; they will not be reused for any similar, subsequently occurring events.

When a Filing Entity initiates an iteration of the Verifiable Cost Process, the following must be submitted to ERCOT:

- the Verifiable Cost Template with all relevant fields completed;
- electronic copies of supporting documentation and any required affidavits and signatures;
- a list of any physical supporting documentation that is being sent to ERCOT; and
- any other relevant materials that this document requires to be submitted.

Note: The timeline within this section pertains to Verifiable Costs, but not to *Event Specific Verifiable Costs*.

A Filing Entity may submit Verifiable Costs at any time, but it must submit those costs no later than 30 days after the QSE receives five (5) RUC instructions for that Resource in a calendar year..

If the RUC process instructs a QSE to start a Resource 50 times within a calendar year, ERCOT will notify the QSE to update its Verifiable Cost data, but ERCOT will not make such a request more frequently than annually. ERCOT will also notify a QSE to update its Verifiable Cost data if at least five years have passed since ERCOT last approved the Resource's Verifiable Cost data. If a Filing Entity does not submit updated data within 30 days of being notified to do so under either of these scenarios, ERCOT will determine payments using the lower of the following until updated costs are approved:

1. Resource Category Startup Generic and Resource Category Minimum-Energy Generic Caps; and
2. the Resource's most recently approved Verified Startup and Minimum Energy Costs (except for *Event Specific Verifiable Costs* which are submitted and applied to a specific Operating Day).

Timeline Applicable to the Submission and Approval of Verifiable Costs

Verifiable Costs submitted to ERCOT after implementation of the Texas Nodal Market will be reviewed based on the following timeline:

1. Once a Resource's verifiable cost data is submitted, ERCOT will review the data for completeness and accuracy and to ensure the submission has met all of the requirements described within the guidelines of ERCOT's Verifiable Cost Manual.

2. Within fifteen (15) Business Days from the date on which the data is submitted, ERCOT will inform the submitting Filing Entity that:
   a. the review is complete and the amounts that ERCOT is able to approve are provided to the Filing Entity;
      i. the review is complete and the submission was rejected,
      ii. the submission was incomplete, or
      iii. additional supporting documentation must be submitted.

3. A Filing Entity must submit any additional information ERCOT requests no later than thirty (30) Business Days after ERCOT first requests it. Multiple submissions of data are permissible, but a complete submission, which includes all information requested, must be made within thirty Business Days of ERCOT"s request.

4. Upon receiving additional documentation, ERCOT will acknowledge receipt and review it for completeness within ten (10) Business Days. If ERCOT receives all requested information, ERCOT will make a decision to approve or reject Verifiable Costs within the same ten (10) Business Days.

5. At any time during the approval process, ERCOT may request additional information from a Filing Entity. All requests must be fulfilled within thirty (30) Business Days.

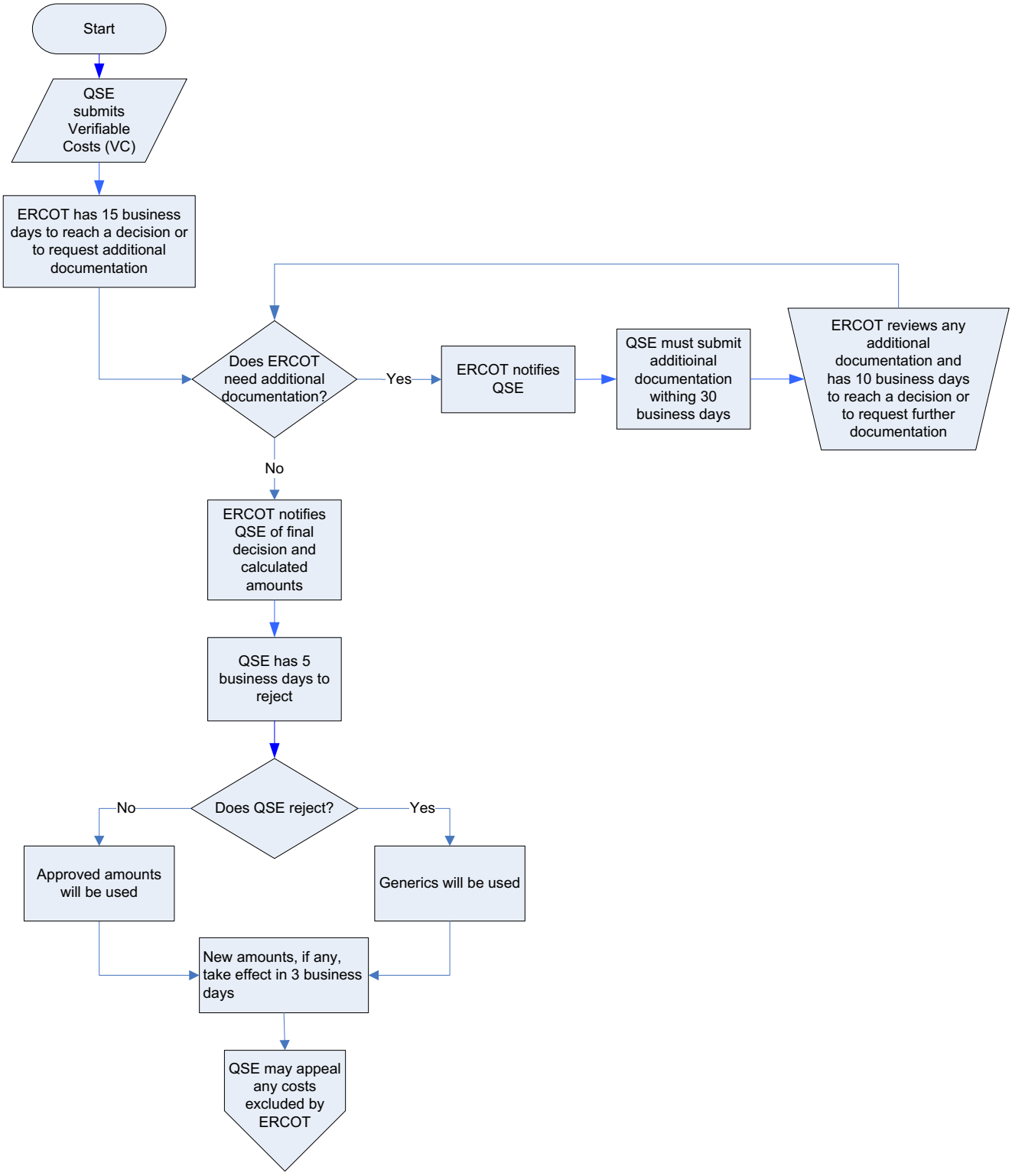
6. From the time that ERCOT's final decision is provided, the Filing Entity has five (5) Business Days to either accept or reject any amounts approved by ERCOT. If the Filing Entity rejects the amounts calculated by ERCOT, generic costs and caps will be used. Failure to accept or reject ERCOT's approvable amounts within these five Business Days will be deemed as acceptance.

7. If ERCOT does not approve a Resource's Verifiable Costs, the Filing Entity may file an appeal in accordance with the procedure described in *Section 12: Appealing Rejected Verifiable Costs*.

8. ERCOT's deadline for reviewing Verifiable Costs submissions (15 or 10 Business Days) applies from the date ERCOT receives a submission. ERCOT *will not* postpone review until a Filing Entity's submission deadline has passed.

Chart 4: Verifiable Cost Submission Timeline

{Reference to "QSE" in the following Timeline should be read to mean "Filing Entity"



Section 11: Timeline for Rescinding Approval of Verifiable Costs

Policy for Rescinding Previously Approved Verifiable Costs

ERCOT has authority to, at any time, review and reject the Verifiable Costs that it has previously approved. ERCOT must, however, be judicious and impartial when rescinding its approval. Furthermore, ERCOT must not rescind Verifiable Costs unless there is a material, factual basis that justifies rescission. For example, rescission would be justified upon ERCOT determining: the submitted data was inaccurate based on public filings or comparisons with substantially similar generators; a type of O&M cost submitted was a fixed cost (or a portion thereof); changed Nodal Market policies disallow or limit certain costs, accounting practices, or calculation methodologies; etc. ERCOT must approach these types of situations with the aim of rescinding approval only to the extent necessary to eliminate all inaccurate cost data.

Rescission of approval does not affect the timing of Verifiable Cost updates mandated under Section 5.6.1 of the Nodal Protocols.

If the entire verifiable cost of a Resource (Fuel and O&M) is rescinded, then the payment to the QSE will be based on the Resource Category Generic Caps.

If ERCOT only rescinds approval for a specific type of costs (or reduces the approved amount), ERCOT will recalculate the Resource's Verifiable Costs using the corrected data, other unchanged amounts, and the previous calculation methodology. The Filing Entity has the option to reject ERCOT's recalculated amount. Generic costs will apply to Resources that reject the amounts recalculated by ERCOT.

Finally, a decision by ERCOT to rescind approval does not immediately take effect. ERCOT must first provide an affected Filing Entity with notice and then permit that entity a chance to respond. During this interim period, the unaltered Verifiable Costs will still be in use.

Timeline Applicable to Rescinding Approval of Verifiable Costs

The process of rescinding Verifiable Costs proceeds according to the following timeline:

1. Once ERCOT decides to initiate rescinding a Resource's Verifiable Costs, ERCOT must provide the Filing Entity with notice of:
    a. the impending rescission;
    b. the amounts and or categories that will no longer be approved;
    c. the specific reason(s) for rescission;
    d. the date on which notice is being provided; and
    e. the last date a Resource may submit explanatory information.

2. A Filing Entity has ten (10) Business Days after the day on which they receive notice to provide ERCOT with any documents, justifications, and other information that supports inclusion of the cost in question. Not submitting supporting information or making untimely submission is deemed as acquiescence.

3. After the passing of the last day a Filing Entity can submit explanatory information, ERCOT has seven (7) Business Days to review all submissions and to reach a decision.

4. ERCOT will inform Filing Entities whether or not it will be rescinding its prior approval within one (1) Business Day of reaching its decision.

5. If ERCOT is sufficiently persuaded by a Filing Entity's supplementary information and determines that no costs had been improperly included, ERCOT will not update the stored Verifiable Costs.

6. If a Filing Entity did not submit any information, if a Filing Entity submitted information that was unpersuasive, or if a Filing Entity submitted information that only persuaded ERCOT to approve a portion of the costs in question, ERCOT must recalculate and update the Resource's Verifiable Costs. These recalculated amounts will be communicated to the Filing Entity at the same time that ERCOT informs the Filing Entity of its decision.

7. Once ERCOT's final decision and recalculated amounts are available, Filing Entities have five (5) Business Days to accept or reject any amounts approved by ERCOT. If a Filing Entity rejects the amounts recalculated by ERCOT, generic costs will be used. Failure to accept or reject ERCOT's approvable amounts within these five Business Days will be deemed as acceptance.

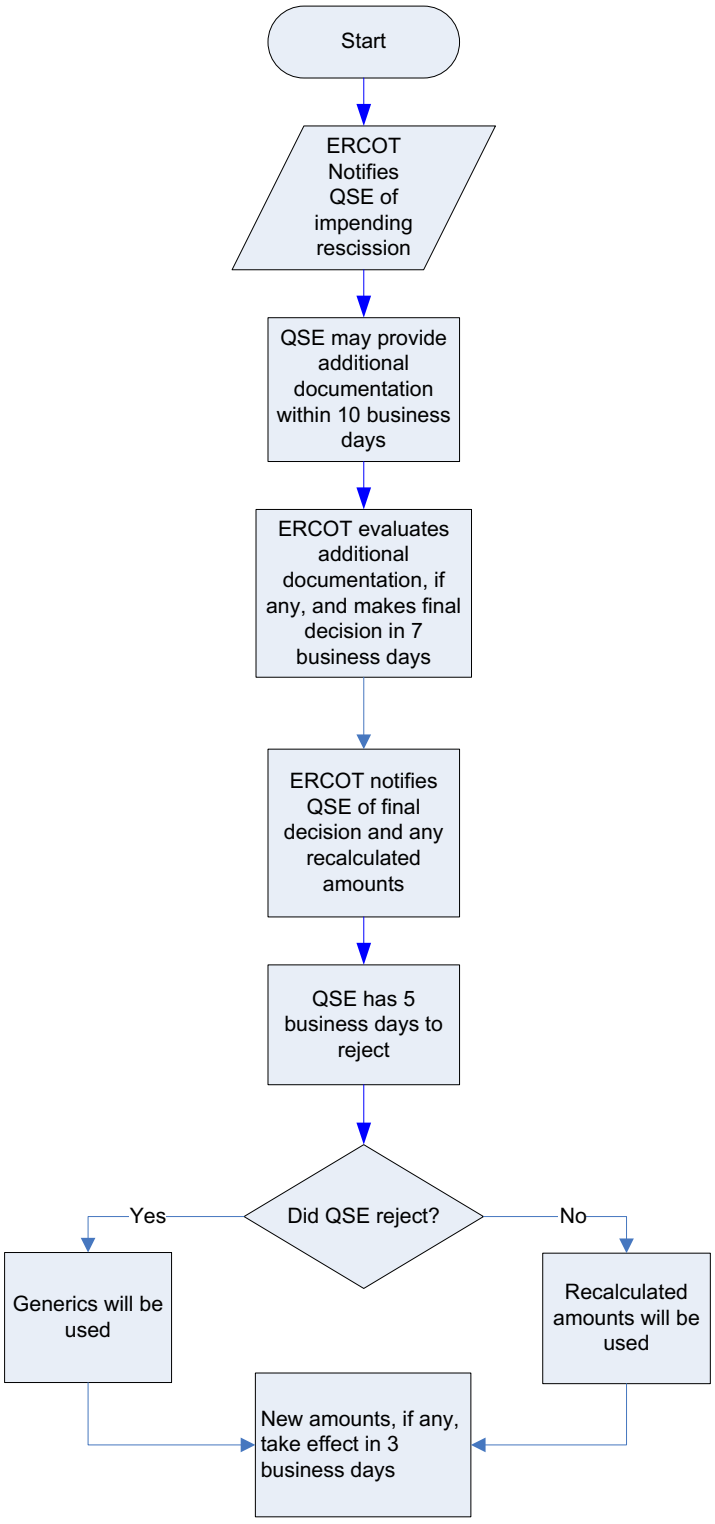
8. Rejection of ERCOT's recalculated amounts will not affect the timing of Verifiable Cost updates mandated under Section 5.6.1 of the Nodal Protocols.

9. Any changes to a Resource's Verifiable Costs—whether due to recalculation or replacement with generics—take effect three (3) Business Days after a Filing Entity accepts them.

Any Filing Entity wishing to appeal a rescission of their Verifiable Costs must follow the procedures provided in *Section 12: Appealing Rejected Verifiable Costs*.

Chart 5: Timeline Applicable to Rescinding Approval of Verifiable Costs

{References to "QSE" in the following Timeline should be read to be "Filing Entity"



Section 12: Appealing Rejected Verifiable Costs

This section of ERCOT's Verifiable Cost Manual describes the policies and procedures that apply when a Filing Entity wishes to appeal a rejection of their Verifiable Costs.

Appealing Verifiable Cost Rejections

If ERCOT denies a Filing Entity's Verifiable Cost submission (or a portion thereof) or if ERCOT rescinds its prior approval of a Filing Entity's Verifiable Cost submission (or a portion thereof), the Filing Entity may appeal ERCOT's decision.

If any additional costs are approved as a result of the appeal process, the additional costs will only be used going forward. The newly approved costs will not be used to resettle prior Operating Days. If the inclusion of the newly approved costs represents a shift in ERCOT's Verifiable Cost doctrine, this Manual will be updated and, if necessary, Nodal Protocol Revision Requests will be drafted. These updates will inform Market Participants of the doctrinal shift, will allow similarly situated Filing Entities to submit analogous costs, and, thus, will ensure that ERCOT approves Verifiable Costs without bias.

Verifiable Cost Appeal Process and Timeline

There are [undetermined] levels of review[2] available to Filing Entities wishing to appeal a rejection of their Verifiable Costs. They are as follow:

First Level of Appeal

- Filing Entities initiate appeals of rejected Verifiable Costs. This is done by submitting an appeal to ERCOT.
- Appeals must be submitted no more than twenty (20) Business Days after ERCOT informs a Filing Entity of its final decision and the rejection. If a Filing Entity does not submit an appeal within this 20 Business Day period, the Filing Entity is deemed to have accepted the rejection.
- A Review Meeting between the appealing Filing Entity and ERCOT must be scheduled to occur within twenty (20) Business Days of a Filing Entity initiating an appeal. This Review Meeting may be held over the phone. When scheduling a Review Meeting, Filing Entities must name a primary and an alternate representative. The Filing Entity's

[2] At this time, it is unknown how many levels of appeal will be available or all parties that will be involved. Specific details in this section that are unknown are represented by a generic description enclosed in brackets. ERCOT is awaiting responses from key parties and is unable to fully detail the appeal process until these are received. ERCOT nevertheless included this incomplete and general framework in the Manual in order to inform Market Participants and to encourage Market Participants to submit feedback and suggestions.

representative will meet with [TBD ERCOT employee(s)], who will represent ERCOT and who is outside of the Settlements and Billing Department.

- Both ERCOT and the appealing Filing Entity must submit a position paper to each other at least two (2) Business Days before the Review Meeting. These papers are to:
  - Explain why a cost or a portion thereof should or should not be included in the Filing Entity's Verifiable Costs;
  - Include copies of documentation that proves the costs were incurred; and
  - Reference sections within the Nodal Protocols, this Manual, or other controlling documents that supports inclusion/exclusion of the disputed costs.

- The goal of this first level of appeal is to reach an agreement and understanding between ERCOT and the Filing Entity as quickly as possible by providing dialog between the Filing Entity and a representative of ERCOT that is external to the Settlements and Billing department.
  - If [TBD ERCOT employee(s)], finds a Filing Entity's arguments and position paper to be persuasive, ERCOT will update the Verifiable Costs to the extent approved by the representative(s). The inclusion of these costs will take effect not more than three (3) Business Days after approval by ERCOT's representative(s).
  - If ERCOT's representative(s) is unpersuaded by the Filing Entity, the rescission or rejection stands.
  - If at any time it becomes apparent from discussions between the Filing Entity and ERCOT that no agreement will be reached or that the positions of the Filing Entity and ERCOT are diametrically opposed, this level of review should quickly be terminated to allow the Filing Entity to elevate their appeal to the next level.
- Review at this level must terminate within 50 Business Days after an appeal is submitted. If no agreement is reached or if ERCOT's representative does not make a decision in this time, the appeal is deemed denied and the rejection/rescission stands.

Second Level of Appeal

This level of appeal is only available to Filing Entities that unsuccessfully appealed ERCOT's treatment of their Verifiable Costs through the first level of appeal. That is, this level of appeal is only open to Filing Entities that timely appealed Settlements and Billing's rejection of their costs but were unable to persuade ERCOT's representative to approve inclusion of a cost (or the extent requested).

A Filing Entity may only appeal the costs or amounts that were rejected by ERCOT's representative in the first level of appeal. If ERCOT's representative and a Filing Entity reach an understanding in the first level of appeal, their agreed upon treatment of a cost is not appealable. For example, if a Filing Entity and ERCOT's representative agree to include 50% of disputed cost "A" but do not agree as to the treatment of disputed cost "B", a Filing Entity may only appeal for the inclusion of cost "B". On the other hand, if a Filing Entity never assents to the partial inclusion of cost "A", the Filing Entity may appeal to have all of cost "A" included.

- Filing Entities initiate this second level of appeal by submitting an appeal to ERCOT through MIS.
- Appeals must be submitted no more than ten (10) Business Days after the termination of the first level of appeal, as determined by the status shown on the MIS. If a Filing Entity does

not submit an appeal within this 10 Business Day period, the Filing Entity loses their right to appeal.

- Appeal at this level is determined by [undetermined party—possibly IMM or ERCOT's unaffiliated members of BoD]. The [undetermined party] will make a decision at [undetermined place/time—next board meeting? a meeting with ERCOT and the Filing Entity within 60 days?].
- To aid [undetermined party] in making their decision, they will receive the position papers and meeting notes from the first level of appeal. Additionally, representatives of ERCOT and the Filing Entity must attend the [undetermined place/meeting] to answer any questions that they [undetermined party] may have.
- If the [undetermined party] approves the inclusion of any additional costs or amounts, ERCOT will update the Filing Entity's Verifiable Costs to the extent approved. The inclusion of these costs will take effect not more than three (3) Business Days after approval by the [undetermined party].
- If [undetermined party] denies inclusion of the appealed costs or amounts, ERCOT's the rescission or rejection stands.

Section 13: Verifiable Cost Manual Revision

13.1 Introduction

(1) A request to make additions, edits, deletions, revisions, or clarifications to this Verifiable Cost Manual, including any attachments and exhibits, is called a Verifiable Cost Manual Revision Request (VCMRR). Except as specifically provided in other sections of the Verifiable Cost Manual, this Section 13, and Verifiable Cost Manual Revision Process, shall be followed for all VCMRRs. ERCOT Members, Market Participants, Public Utility Commission of Texas (PUCT) Staff, Texas Reliability Entity (Texas RE) Staff, ERCOT, and any other Entities are required to utilize the process described herein prior to requesting, through the PUCT or other Governmental Authority, that ERCOT make a change to the Verifiable Cost Manual, except for good cause shown to the PUCT or other Governmental Authority.

(2) The "next regularly scheduled meeting" of the Wholesale Market Subcommittee (WMS), the Technical Advisory Committee (TAC) or the ERCOT Board shall mean the next regularly scheduled meeting for which required Notice can be timely given regarding the item(s) to be addressed, as specified in the appropriate ERCOT Board or committee procedures.

(3) ERCOT may make non-substantive corrections at any time during the processing of a particular VCMRR. Under certain circumstances, however, the Verifiable Cost Manual can also be revised by ERCOT rather than using the VCMRR process outlined in this Section.

(a) This type of revision is referred to as an "Administrative VCMRR" or "Administrative Changes" and shall consist of non-substantive corrections, such as typos (excluding grammatical changes), internal references (including table of contents), improper use of acronyms, references to ERCOT Protocols, PUCT Substantive Rules, the Public Utility Regulatory Act (PURA), North American Electric Reliability Corporation (NERC) regulations, Federal Energy Regulatory Commission (FERC) rules, etc., and revisions for the purpose of maintaining consistency between Section 13 and Protocol Section 21, Revision Request Process.

(b) ERCOT shall post such Administrative VCMRRs on the ERCOT website and distribute the VCMRR to the WMS at least ten Business Days before implementation. If no Entity submits comments to the Administrative VCMRR in accordance with paragraph (1) of Section 13.3.3, Wholesale Market Subcommittee Vote, ERCOT shall implement it according to paragraph (4) of Section 13.6, Verifiable Cost Manual Revision Implementation. If any ERCOT Member, Market Participant, PUCT Staff, Texas RE Staff or ERCOT submits comments to the Administrative VCMRR, then it shall be processed in accordance with the VCMRR process outlined in this Section 13.

13.2 Submission of a Verifiable Cost Manual Revision Request

The following Entities may submit a Verifiable Cost Manual Revision Request (VCMRR):

(a) Any Market Participant;

(b) Any ERCOT Member;

(c) Public Utility Commission of Texas (PUCT) Staff;

(d) Texas Reliability Entity (Texas RE) Staff;

(e) ERCOT; and

(f) Any other Entity that meets the following qualifications:

(i) Resides (or represents residents) in Texas or operates in the Texas electricity market; and

(ii) Demonstrates that Entity (or those it represents) is affected by the Customer Registration or Renewable Energy Credit (REC) Trading Program sections of the ERCOT Protocols.

13.3 Verifiable Cost Manual Revision Procedure

13.3.1 Review and Posting of Verifiable Cost Manual Revision Requests

(1) Verifiable Cost Manual Revision Requests (VCMRRs) shall be submitted electronically to ERCOT by completing the designated form provided on the ERCOT website. ERCOT shall provide an electronic return receipt response to the submitter upon receipt of the VCMRR.

(2) The VCMRR shall include the following information:

(a) Description of requested revision and reason for suggested change;

(b) Impacts and benefits of the suggested change on ERCOT market structure, ERCOT operations, and Market Participants to the extent that the submitter may know this information;

(c) Impact Analysis (applicable only for a VCMRR submitted by ERCOT);

(d) List of affected Verifiable Cost Manual sections and subsections;

(e) General administrative information (organization, contact name, etc.); and

(f) Suggested language for requested revision.

(3) ERCOT shall evaluate the VCMRR for completeness and shall notify the submitter, within five Business Days of receipt, if the VCMRR is incomplete, including the reasons for such status. ERCOT may provide information to the submitter that will correct the VCMRR and render it complete. An incomplete VCMRR shall not receive further consideration until it is completed. In order to pursue the VCMRR, a submitter must submit a completed version of the VCMRR.

(4) If a submitted VCMRR is complete or once a VCMRR is completed, ERCOT shall post the VCMRR on the ERCOT website and distribute to the Wholesale Market Subcommittee (WMS) within three Business Days.

13.3.2 Withdrawal of a Verifiable Cost Manual Revision Request

(1) A submitter may withdraw or request to withdraw a VCMRR by submitting a completed Request for Withdrawal form provided on the ERCOT website. ERCOT shall post the submitter's Request for Withdrawal on the ERCOT website within three Business Days of submittal.

(2) The submitter of a VCMRR may withdraw the VCMRR at any time before WMS recommends approval of the VCMRR.

(3) If the WMS has recommended approval of the VCMRR, the Request for Withdrawal must be approved by the Technical Advisory Committee (TAC) if the VCMRR has not yet been approved or recommended for approval by TAC.

(4) If TAC has recommended approval of a VCMRR that requires an ERCOT project for implementation, the Request for Withdrawal must be approved by the ERCOT Board if the VCMRR has not yet been approved by the ERCOT Board.

(5) Once a VCMRR that requires an ERCOT project for implementation is approved by the ERCOT Board or a VCMRR that does not require an ERCOT project for implementation is approved by TAC, such VCMRR cannot be withdrawn.

13.3.3 Wholesale Market Subcommittee Vote

(1) Any ERCOT Member, Market Participant, Public Utility Commission of Texas (PUCT) Staff, Texas Reliability Entity (Texas RE) Staff or ERCOT may comment on the VCMRR.

(2) To receive consideration, comments must be delivered electronically to ERCOT in the designated format provided on the ERCOT website within seven days from the posting date of the VCMRR. Comments submitted after the seven-day comment period may be considered at the discretion of the WMS after these comments have been posted. Comments submitted in accordance with the instructions on the ERCOT website regardless of date of submission shall be posted on the ERCOT website and distributed electronically to the WMS within three Business Days of submittal.

(3) WMS shall consider the VCMRR at its next regularly scheduled meeting after the end of the seven-day comment period. At such meeting, the WMS may take action on the VCMRR. The quorum and voting requirements for WMS action are set forth in the Technical Advisory Committee Procedures. In considering action on a VCMRR, WMS may:

(a) Recommend approval of the VCMRR as submitted or as modified;

(b) Reject the VCMRR;

(c) Defer decision on the VCMRR; or

(d) Refer the VCMRR to another WMS working group or task force or another TAC subcommittee with instructions.

(4) If a motion is made to recommend approval of a VCMRR and that motion fails, the VCMRR shall be deemed rejected by WMS unless at the same meeting WMS later votes to

recommend approval of, defer, or refer the VCMRR. If a motion to recommend approval of a VCMRR fails via e-mail vote according to the Technical Advisory Committee Procedures, the VCMRR shall be deemed rejected by the WMS unless at the next regularly scheduled WMS meeting or in a subsequent e-mail vote prior to such meeting, WMS votes to recommend approval of, defer, or refer the VCMRR. The rejected VCMRR shall be subject to appeal pursuant to Section 13.4, Appeal of Action.

(5) Within three Business Days after the WMS takes action on the VCMRR, ERCOT shall issue a WMS Report reflecting the WMS action and post it on the ERCOT website. The WMS Report shall contain the following items:

(a) Identification of submitter of the VCMRR;

(b) Modified Verifiable Cost Manual language recommended by the WMS, if applicable;

(c) Identification of authorship of comments, if applicable;

(d) Proposed effective date of the VCMRR;

(e) Recommended priority and rank for any VCMRR requiring an ERCOT project for implementation and for which WMS has reviewed an Impact Analysis; and

(f) WMS action.

13.3.4 Comments to the Wholesale Market Subcommittee Report

(1) Any ERCOT Member, Market Participant, PUCT Staff, Texas RE Staff or ERCOT may comment on the WMS Report. Within three Business Days of receipt of comments related to the WMS Report, ERCOT shall post such comments to the ERCOT website. Comments submitted in accordance with the instructions on the ERCOT website, regardless of date of submission, shall be posted on the ERCOT website within three Business Days of submittal.

(2) The comments on the WMS Report will be considered at the next regularly scheduled TAC meeting where the VCMRR is being considered.

13.3.5 Verifiable Cost Manual Revision Request Impact Analysis

(1) ERCOT shall submit to WMS an initial Impact Analysis based on the original language in the VCMRR with any ERCOT-sponsored VCMRR. The initial Impact Analysis will provide WMS with guidance as to what ERCOT computer systems, operations, or business functions could be affected by the VCMRR as submitted.

(2) If WMS recommends approval of a VCMRR, ERCOT shall prepare an Impact Analysis based on the proposed language in the WMS Report. If ERCOT has already prepared an Impact Analysis, ERCOT shall update the existing Impact Analysis, if necessary, to accommodate the language recommended for approval in the WMS Report.

(3) The Impact Analysis shall assess the impact of the proposed VCMRR on ERCOT staffing, computer systems, operations, or business functions and shall contain the following information:

(a) An estimate of any cost and budgetary impacts to ERCOT for both implementation and ongoing operations;

(b) The estimated amount of time required to implement the VCMRR;

(c) The identification of alternatives to the VCMRR that may result in more efficient implementation; and

(d) The identification of any manual workarounds that may be used as an interim solution and estimated costs of the workaround.

(4) Unless a longer review period is warranted due to the complexity of the proposed WMS Report, ERCOT shall issue an Impact Analysis for a VCMRR for which WMS has recommended approval of prior to the next regularly scheduled TAC meeting. ERCOT shall post the results of the completed Impact Analysis on the ERCOT website. If a longer review period is required by ERCOT to complete an Impact Analysis, ERCOT shall submit comments with a schedule for completion of the Impact Analysis to TAC.

13.3.6 Review of Impact Analysis

After ERCOT posts the results of the Impact Analysis, either the Protocol Revision Subcommittee (PRS) or TAC shall review the Impact Analysis as follows:

(a) For a VCMRR that requires an ERCOT project for implementation, PRS shall review the WMS Report and Impact Analysis at the next regularly scheduled PRS meeting after WMS recommends approval and shall assign a recommended priority and rank for the associated project. Within three Business Days following such PRS recommendation, ERCOT shall issue a PRS Report reflecting the PRS recommendation and post it on the ERCOT website.

(b) For a VCMRR that does not require an ERCOT project for implementation, TAC shall review the WMS Report and Impact Analysis pursuant to Section 13.3.7, Technical Advisory Committee Vote.

13.3.7 Technical Advisory Committee Vote

(1) TAC shall consider any VCMRR that WMS or PRS, as applicable pursuant to Section 13.3.6, Review of Impact Analysis, has submitted to TAC for consideration for which both an Impact Analysis and either a PRS Report or WMS Report have been posted on the ERCOT website. The following information must be included for each VCMRR considered by TAC:

(a) The Impact Analysis and either the PRS Report or WMS Report, as applicable;

(b) The recommended priority and rank, if an ERCOT project is required; and

(c) Any comments timely received in response to the PRS Report or WMS Report.

(2) The quorum and voting requirements for TAC action are set forth in the Technical Advisory Committee Procedures. In considering action on a PRS Report or WMS Report, TAC shall:

(a) Approve the VCMRR as recommended in WMS Report or as modified by TAC, if the VCMRR does not require an ERCOT project for implementation;

(b) Recommend approval of the VCMRR as recommended in the PRS Report or as modified by TAC, including modification of the recommended priority and rank, if the VCMRR requires an ERCOT project for implementation;

(c) Reject the VCMRR;

(d) Defer decision on the VCMRR;

(e) Remand the VCMRR to PRS or WMS with instructions; or

(f) Refer the VCMRR to another TAC subcommittee or a TAC working group or task force with instructions.

(3) If a motion is made to approve or recommend approval of a VCMRR and that motion fails, the VCMRR shall be deemed rejected by TAC unless at the same meeting TAC later votes to approve, recommend approval of, defer, remand, or refer the VCMRR. If a motion to approve or recommend approval of a VCMRR fails via e-mail vote according to the Technical Advisory Committee Procedures, the VCMRR shall be deemed rejected by TAC unless at the next regularly scheduled TAC meeting or in a subsequent e-mail vote prior to such meeting, TAC votes to approve, recommend approval of, defer, remand, or refer the VCMRR. The rejected VCMRR shall be subject to appeal pursuant to Section 13.4, Appeal of Action.

(4) Within three Business Days after TAC takes action on a VCMRR, ERCOT shall issue a TAC Report reflecting the TAC action and post it on the ERCOT website. The TAC Report shall contain the following items:

(a) Identification of the submitter of the VCMRR;

(b) Modified Verifiable Cost Manual language proposed by TAC, if applicable;

(c) Identification of the authorship of comments, if applicable;

(d) Proposed effective date of the VCMRR;

(e) WMS action;

(f) PRS action and recommended priority and rank for any VCMRR requiring an ERCOT project for implementation;

(g) TAC action; and

(h) ERCOT's position for any VCMRR requiring an ERCOT project for implementation.

(5) If TAC recommends approval of a VCMRR requiring an ERCOT project for implementation, ERCOT shall forward the TAC Report to the ERCOT Board for consideration pursuant to Section 13.3.8, ERCOT Board Vote.

(6) The TAC chair shall report the results of all votes by TAC related to VCMRRs to the ERCOT Board at its next regularly scheduled meeting.

13.3.8 ERCOT Board Vote

(1) For any VCMRR requiring an ERCOT project for implementation, upon issuance of a TAC Report and Impact Analysis to the ERCOT Board, the ERCOT Board shall review the TAC Report and the Impact Analysis at the following month's regularly scheduled meeting.

(2) The quorum and voting requirements for ERCOT Board action are set forth in the ERCOT Bylaws. In considering action on a TAC Report, the ERCOT Board shall:

(a) Approve the VCMRR as recommended in the TAC Report or as modified by the ERCOT Board;

(b) Reject the VCMRR;

(c) Defer decision on the VCMRR; or

(d) Remand the VCMRR to TAC with instructions.

(3) If a motion is made to approve a VCMRR and that motion fails, the VCMRR shall be deemed rejected by the ERCOT Board unless at the same meeting the ERCOT Board later votes to approve, defer, or remand the VCMRR. The rejected VCMRR shall be subject to appeal pursuant to Section 13.4, Appeal of Action.

(4) Within three Business Days after the ERCOT Board takes action on a VCMRR, ERCOT shall issue a Board Report reflecting the ERCOT Board action and post it on the ERCOT website.

13.4 Appeal of Action

(1) Any ERCOT Member, Market Participant, Public Utility Commission of Texas (PUCT) Staff, Texas Reliability Entity (Texas RE) Staff or ERCOT may appeal a Wholesale Market Subcommittee (WMS) action to reject, defer, or refer a Verifiable Cost Manual Revision Request (VCMRR) directly to the Technical Advisory Committee (TAC). Such appeal to TAC must be submitted electronically to ERCOT by completing the designated form provided on the ERCOT website within seven days after the date of the relevant WMS appealable event. ERCOT shall reject appeals made after that time. ERCOT shall post appeals on the ERCOT website within three Business Days of receiving the appeal. Appeals shall be heard at the next regularly scheduled TAC meeting that is at least seven days after the date of the requested appeal. An appeal of a VCMRR to TAC suspends consideration of the VCMRR until the appeal has been decided by TAC.

(2) Any ERCOT Member, Market Participant, PUCT Staff, Texas RE Staff or ERCOT may appeal a TAC action to approve, reject, defer, remand, or refer a VCMRR directly to the

ERCOT Board. Appeals to the ERCOT Board shall be processed in accordance with the ERCOT Board Policies and Procedures. An appeal of a VCMRR to the ERCOT Board suspends consideration of the VCMRR until the appeal has been decided by the ERCOT Board.

(3) Any ERCOT Member, Market Participant, PUCT Staff or Texas RE Staff may appeal any decision of the ERCOT Board regarding a VCMRR to the PUCT or other Governmental Authority. Such appeal to the PUCT or other Governmental Authority must be made within any deadline prescribed by the PUCT or other Governmental Authority, but in any event no later than 35 days of the date of the relevant ERCOT Board appealable event. Notice of any appeal to the PUCT or other Governmental Authority must be provided, at the time of the appeal, to ERCOT's General Counsel. If the PUCT or other Governmental Authority rules on the VCMRR, ERCOT shall post the ruling on the ERCOT website.

13.5 Acceleration or Alteration of VCMRR Procedures

If a VCMRR requires immediate attention, the Wholesale Market Subcommittee (WMS) chair or Technical Advisory Committee (TAC) chair may request action from TAC to accelerate or alter the procedures described herein, as needed, to address the urgency of the situation. Notwithstanding the above, all VCMRRs shall be subject to an Impact Analysis pursuant to Section 13.3.6, Review of Impact Analysis, and TAC consideration pursuant to Section 13.3.7, Technical Advisory Committee Vote.

13.6 Verifiable Cost Manual Revision Implementation

(1) For Verifiable Cost Manual Revision Requests (VCMRRs) that do not require an ERCOT project for implementation, upon Technical Advisory Committee (TAC) approval, ERCOT shall implement VCMRRs on the first day of the month following TAC approval, unless otherwise provided in the TAC Report for the approved VCMRR.

(2) For VCMRRs that require an ERCOT project for implementation, upon ERCOT Board approval, ERCOT shall update the Verifiable Cost Manual to reflect pending VCMRR changes on the first day of the month following ERCOT Board approval, unless otherwise provided in the Board Report for the approved VCMRR.d Additionally, ERCOT shall provide Notice as soon as practicable, but no later than ten days prior to the actual implementation and effectiveness of the VCMRR language, unless a different Notice period is required in the TAC or Board Report, as applicable, for the approved VCMRR.

(3) ERCOT shall implement an Administrative VCMRR on the first day of the month following the end of the ten Business Day posting requirement outlined in Section 13.1, Introduction.

Appendix 1A: Methodology for Determining Maintenance Costs of Nuclear and Fossil Steam Units.

This procedure is not subject to WMS approval since only ERCOT has the authority to approve all methodologies as per Protocol section 5.6.1 (3) (iii).

Example Calculation of Total Maintenance Dollars using Operating Year of 1998

$$TMD = (C_{97} * F_{97}) + (C_{96} * F_{96}) \ldots + (C_{88} * F_{88})$$

Where:

- C = Total dollars spent on maintenance during a particular year
- F = Escalation Factor for a particular year, as approved by ERCOT and based on the Cost Escalation Factors as shown in Figure 2.

Note: TMD must be calculated for the same historical period as Equivalent Service Hours.

How to Calculate Equivalent Service Hours (ESH)

$$ESH = (A_c * NS_c + A_i * NS_i + A_h * NS_h) + Z \text{ hours}$$

Where:

- A_c = Cold starting factor = 30.0

  This implies that the incremental maintenance charged to one cold start is equivalent to the incremental maintenance attributable to thirty hours of base load operation.

- A_i = Intermediate starting factor = 0.7 * 30.0 = 21.0

- A_h = Hot starting factor = 0.5 * 30.0 = 15.0

- NS_c = Number of cold starts over the historical period

- NS_i = Number of intermediate starts over the historical period

- NS_h = Number of hot starts over the historical period

- Z = Total unit operating hours at any load level over the historical period

Note: ESH must be calculated using all available history in the Maintenance Period. Filing Entities may propose alternative starting factors for individual units. Such alternative factor proposals should include supporting documentation (e.g., manufacturer recommendation) of this new factor, to be reviewed for approval by ERCOT, on a case-by-case basis.

How to Calculate Equivalent Hourly Maintenance Cost (EHMC)

EHMC = TMD / ESH

Where:

- TMD = Total maintenance dollars as approved by ERCOT
- ESH = Equivalent service hours
- EHMC is in terms of $/hour

Applying Equivalent Hours Maintenance Costs to Calculate Maintenance Start Rates:

Cold Start Maintenance Cost ($/Cold-Start) = A_c * EHMC

Intermediate Start Maintenance Cost ($/Intermediate-Start) = A_i * EHMC

Hot Start Maintenance Cost ($/Hot-Start) = A_h * EHMC

Where:

- A_c, A_i, A_h = Individual starting factors as defined above
- EHMC = Hourly Maintenance Cost ($/Hour)

How to Calculate Maintenance Cost Rate (MCR) for Energy Produced

MCR = (TMD - TSD) / TMWH

Where:

- MCR = Maintenance Cost Rate, $/MWh
- TSD = Total Start maintenance Dollars over the historical period

  = $NS_c * A_c * EHMC + NS_i * A_i * EHMC + NS_h * A_h * EHMC$

- TMWH = Total energy generation over the historical period, MWh

Note: The MCR value applies to operation over all output levels including operations at LSL and the entire range from LSL to HSL.

Example Calculation Using Above Methodology

If:

- Service Hours = Z = 60,000hr
- Number of Cold Starts = 100
- Number of Intermediate Starts = 50
- Number of Hot Starts = 1,000

- TMD = $10,000,000 (Actual historical maintenance data escalated to present value)
- TMWH = 5,000,000 MWh

Then Equivalent Hourly Maintenance Cost:

EHMC = $10,000,000 / [(30*100 + 21*50 + 15*1,000) + 60,000] = $126.50/hr

Cold Start Maintenance Cost = A_c * EHMC = 30 * $126.50/hr = $3,795.00/Cold-Start

Intermediate Start Maintenance Cost = A_i * EHMC = 21 * $126.50/hr = $2,656.50/Intermediate-Start

Hot Start Maintenance Cost = A_h * EHMC = 15 * $126.50/hr = $1,897.50/Hot-Start

TSD = NS_c * A_c * EHMC + NS_i * A_i * EHMC + NS_h * A_h * EHMC = 100 * 30 * 126.50 + 50 * 21 * 126.50 + 1,000 * 15 * 126.50 = $2,409,825

MCR = (TMD - TSD) / TMWH = (10,000,000 - 2,409,825) / 5,000,000 = $1.52/MWh

Appendix 1B: Methodology for Determining the Maintenance Costs of CT and CCP Units

This procedure is not subject to WMS approval since only ERCOT has the authority to approve all methodologies as per Protocol section 5.6.1 (3) (iii).

Example Calculation of Total Maintenance Dollars using Operating Year of 1998

$$TMD = (C_{97} * F_{97}) + (C_{96} * F_{96}) \ldots + (C_{88} * F_{88})$$

Where:

- C = Total dollars spent on maintenance during a particular year
- F = Escalation Factor for a particular year, as approved by ERCOT and based on the Cost Escalation Factors as shown in Figure 2.

Note: TMD must be calculated for the same historical period as Equivalent Service Hours.

How to Calculate Equivalent Service Hours (ESH)

$$ESH = (A * NS) + Z \text{ hours}$$

Where:

- A = Cyclic starting factor (A = 5.0 for aircraft - type CT's; A = 10.0 for industrial - type CT's)

  For example, the incremental maintenance charged to one start on an industrial - type CT is equivalent to the incremental maintenance attributable to ten hours of base load operation.

- NS = Number of Starts over the historical period

- Z = Total unit operating hours at any load level over the historical period

Note: ESH must be calculated using all available history in the Maintenance Period. Filing Entities may propose alternative cyclic starting factors or cyclic peaking factors for individual units. Such alternative factor proposals should include supporting documentation (e.g., manufacturer recommendation) of this new factor, to be reviewed for approval by ERCOT, on a case-by-case basis.

How to Calculate Equivalent Hourly Maintenance Cost (EHMC)

$$EHMC = TMD / ESH$$

Where:

- TMD = Total maintenance dollars as approved by ERCOT
- ESH = Equivalent service hours

- EHMC is in terms of $/hour

Applying Equivalent Hours Maintenance Costs to Calculate Maintenance Rates:

Starting Maintenance Cost ($/Start) = A * EHMC

Where:

- A = Cyclic starting factor as defined above
- EHMC = Hourly Maintenance Cost ($/Hour)

  This hourly value is assigned as a capacity cost and is independent of unit loading.

Comments:

1. The above formulations are applicable for determination of Maintenance Cost Adder for both aircraft and industrial type combustion turbines.

2. CT incremental costs may only be developed and applied on a unit-by-unit basis

How to Calculate Maintenance Cost Rate (MCR) for Energy Produced

MCR = (TMD - TSD) / TMWH

Where:

- MCR = Maintenance Cost Rate, $/MWh
- TSD = Total Start maintenance Dollars over the historical period

  = NS * A * EHMC
- TMWH = Total energy generation over the historical period, MWh

Note: The MCR value applies to operation overall output levels including operations at LSL and the entire range from LSL to HSL.

Example Calculation of the Maintenance Adder for a Combustion Turbine

If:

- Service Hours = Z = 2000hr (Total Base Peak Hours)
- Number of Starts = 300
- A = 10(*Note*: A = 5 for aircraft engine CT's)
- TMD = $100,000 (Actual historical maintenance data escalated to present value)
- TMWH = 20,000 MWh

Then Equivalent Hourly Maintenance Cost:

EHMC = $100,000 / [(10*300) + 2,000] = $20.00/hr

Starting Maintenance Cost = A * EHMC = 10 * $20.00/hr = $200.00/Start

TSD = NS * A * EHMC = 300 * 10 * 20.00 = $60,000

MCR = (TMD - TSD) / TMWH = (100,000 - 60,000) / 20,000 = $2.00/MWh

Appendix 2: Auxiliary Data

Figure 1: Emission Factors

Technology	Emission Factors (Lbs/MWh)					
	NOx	VOC	CO	CO2	SOx	PM10
Conventional Combined Cycle	0.056	0.017	0.049	817.62	0.007	0.035
Conventional Combined Cycle - Duct Fired	0.064	0.018	0.050	828.14	0.007	0.028
Advanced Combined Cycle	0.046	0.016	0.046	761.47	0.007	0.026
Conventional Simple Cycle	0.093	0.023	0.093	1083.84	0.009	0.065
Small Simple Cycle	0.093	0.023	0.093	1083.84	0.009	0.065
Advanced Simple Cycle	0.076	0.019	0.053	886.63	0.008	0.053
Integrated Gasification Combined Cycle (IGCC)	0.530	0.000	0.000	1928.00	0.300	0.000
Nuclear	0.000	0.000	0.000	0.000	0.000	0.000
Biomass - AD Dairy	1.700	0.000	0.000	0.000	0.390	0.000
Biomass - AD Food	1.700	0.000	0.000	0.000	0.420	0.000
Biomass Combustion - Fluidized Bed Boiler	1.240	0.000	0.000	0.000	0.700	0.000
Biomass Combustion - Stoker Boiler	1.240	0.000	0.000	0.000	0.700	0.000
Biomass - IGCC	0.850	0.000	0.000	0.000	0.700	0.000
Biomass - LFG	1.700	0.000	0.000	0.000	0.340	0.000
Biomass - WWTP	1.700	0.000	0.000	0.000	0.390	0.000
Fuel Cell - Molten Carbonate	0.010	0.000	0.000	0.000	0.003	0.000
Fuel Cell - Proton Exchange	0.100	0.000	0.000	0.000	0.000	0.000
Fuel Cell - Solid Oxide	0.050	0.000	0.000	0.000	0.000	0.000
Geothermal - Binary	0.000	0.000	0.000	0.000	0.000	0.000
Geothermal - Dual Flash	0.000	0.000	0.000	60.000	0.350	0.000
Hydro - In Conduit	0.000	0.000	0.000	0.000	0.000	0.000
Hydro - Small Scale	0.000	0.000	0.000	0.000	0.000	0.000
Ocean - Wave	0.000	0.000	0.000	0.000	0.000	0.000
Solar - PV	0.000	0.000	0.000	0.000	0.000	0.000
Solar - Parabolic Trough	0.000	0.000	0.000	0.000	0.000	0.000
Solar - Stirling Dish	0.000	0.000	0.000	0.000	0.000	0.000
Solar - Concentrating PV	0.000	0.000	0.000	0.000	0.000	0.000
Wind - Class 5	0.000	0.000	0.000	0.000	0.000	0.000

Source: California Energy Commission, *Comparative Costs of California Central Station Electricity Generation Technologies, June 2007 CEC-200-2007-011-SD Report*, p. 18 available at http://www.energy.ca.gov/2007publications/CEC-200-2007-011/CEC-200-2007-011-SD.PDF.

Cost Escalation Factors

Maintenance Escalation Numbers

Please refer to the Verifiable Costs Submission Template for the latest Maintenance Escalation Numbers as shown in the link below.

http://www.ercot.com/mktinfo/settlements/

Appendix 3: Example Calculations of Power Purchase & Tolling Agreements Verifiable Cost Caps

Example 1: PPAs indicating only one (1) cost for the Resource; no fuel volume shown

Example 1 consists of Tables 1, 2, 3 and 4 and demonstrates the cases where the PPA has submitted only the total cost for the Resource and shows the calculations for Startup costs under cold, hot and intermediate conditions as well as costs at LSL (Table 4). This example demonstrates how the PPA is capped under these conditions.

In all the cases where the PPA contains only the total cost for the Resource, the verifiable costs are capped by the highest total cost calculated from similar non-PPA units. The verifiable costs established for the capped PPA Resources are deemed to have the same fuel and O&M costs as the highest non-PPA unit.

Table 1: Cold Start-Up Cost for Simple Cycle > 90 MW Resources

Cold Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
PPA Cost ($)					9,600(1)	15,000(1)	10,000(1)
Fuel to LSL (MMBtu)	100	120	90	80			
Average FIP over the last 30 days ($/MMBtu)	10	10	10	10			
Total Fuel Cost ($) Fuel x FIP	1,000	1,200	900	800			
Total O&M Cost ($)	8,700	7,000	6,000	9,000			
Total Fuel + O&M Cost ($)	9,700	8,200	6,900	9,800			
Approved VC Fuel Cap (MMBtu)	N/A	N/A	N/A	N/A	N/A	80	80
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	9,600	9,000	9,000

(1) Approved VC = Minimum {Reference Resource or PPA}

[VCMRR005: Replace Table 1 above with the following upon system implementation of NPRR664:]

Cold Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
PPA Cost ($)					9,600(1)	15,000(1)	10,000(1)

Fuel to LSL (MMBtu)	100	120	90	80			
Average $FIPR_r$ over the last 30 days ($/MMBtu)	10	10	10	10			
Total Fuel Cost ($) Fuel x $FIPR_r$	1,000	1,200	900	800			
Total O&M Cost ($)	8,700	7,000	6,000	9,000			
Total Fuel + O&M Cost ($)	9,700	8,200	6,900	9,800			
Approved VC Fuel Cap (MMBtu)	N/A	N/A	N/A	N/A	N/A	80	80
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	9,600	9,000	9,000

(1) Approved VC = Minimum {Reference Resource or PPA}

In Table 1, the largest cost for the four Resources (Units 1 through 4) is $9,800 which is that for Unit 4. Thus PPAs for Units 6 and 7 are capped at $9,800 while the cost for PPA Unit 5 is set at $9,600 (the submitted amount).

Table 2: Hot Start-Up Cost for Simple Cycle > 90 MW Resources

Hot Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
PPA Cost* ($)					4800(1)	7500(1)	5000(1)
Fuel to LSL (MMBtu)	65	80	70	60			
Average FIP over the last 30 days ($/MMBtu)	10	10	10	10			
Total Fuel Cost ($) Fuel x FIP	650	800	700	600			
Total O&M Cost ($)	6000	4000	3500	6000			
Total Fuel + O&M Cost ($)	6,650	4,800	4,200	6,600			
Approved VC Fuel Cap (MMBtu)	N/A	N/A	N/A	N/A	N/A	65	N/A

Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	4,800	6,000	5,000

(1) Costs for a hot start is calculated by multiplying a Relative Weight 0.5 by the cost for a cold start

[VCMRR005: Replace Table 2 above with the following upon system implementation of NPRR664:]

Hot Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
PPA Cost* ($)					4800(1)	7500(1)	5000(1)
Fuel to LSL (MMBtu)	65	80	70	60			
Average $FIPR_r$ over the last 30 days ($/MMBtu)	10	10	10	10			
Total Fuel Cost ($) Fuel x $FIPR_r$	650	800	700	600			
Total O&M Cost ($)	6000	4000	3500	6000			
Total Fuel + O&M Cost ($)	6,650	4,800	4,200	6,600			
Approved VC Fuel Cap (MMBtu)	N/A	N/A	N/A	N/A	N/A	65	N/A
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	4,800	6,000	5,000

(1) Costs for a hot start is calculated by multiplying a Relative Weight 0.5 by the cost for a cold start

In Table 2 the highest cost of the four non-PPA Resources is that of Unit 1 ($6,650); thus the Cap for the PPA Units is set at this level. Note that the verifiable costs for PPA Units 5 and 7 are set at their submitted amounts since they are less than the Cap.

Table 3: Intermediate Start-Up Cost for Simple Cycle > 90 MW Resources

Inter Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
PPA Cost* ($)					6720(1)	10500(1)	7000(1)
Fuel to LSL (MMBtu)	75	100	80	70			
Average FIP over the last 30 days ($/MMBtu)	10	10	10	10			
Total Fuel Cost ($) Fuel x FIP	750	1000	800	700			
Total O&M Cost ($)	7000	5000	4500	7000			
Total Fuel + O&M Cost ($)	7750	6000	5300	7700			
Approved VC Fuel Cap (MMBtu)	N/A	N/A	N/A	N/A	N/A	75	N/A
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	6,720	7,000	7,000

(1) Costs for an intermediate start is calculated by multiplying a Relative Weight 0.7 by the cost for a cold start

[VCMRR005: Replace Table 3 above with the following upon system implementation of NPRR664:]

Inter Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
PPA Cost* ($)					6720(1)	10500(1)	7000(1)
Fuel to LSL (MMBtu)	75	100	80	70			
Average $FIPR_r$ over the last 30 days ($/MMBtu)	10	10	10	10			
Total Fuel Cost ($) Fuel x $FIPR_r$	750	1000	800	700			
Total O&M Cost ($)	7000	5000	4500	7000			
Total Fuel + O&M Cost ($)	7750	6000	5300	7700			
Approved VC Fuel Cap (MMBtu)	N/A	N/A	N/A	N/A	N/A	75	N/A

Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	6,720	7,000	7,000	

(1) Costs for an intermediate start is calculated by multiplying a Relative Weight 0.7 by the cost for a cold start

Similarly in Table 3, the highest cost for Resources 1 through 4 is that of Unit 1 and the Cap for the PPAs is $7,750. Please note again that the verifiable costs for PPA units 5 and 7 are set at the submitted amounts (less than the calculated Cap).

Table 4: Minimum Energy {@ LSL} PPA Cap for Simple Cycle > 90MW Resources

Resource	PPA Cost ($/MWh)	Fuel at LSL (MMBtu/MWhr)	Average FIP over the last 30 days ($/MMBtu)	Resource Fuel MMBtu/MWh = PPA Cost/FIP	Resource Fuel Cost ($/MWh) = Fuel x FIP	O&M ($/MWh)	Total Cost ($/MWh) Fuel +O&M	Approved VC Fuel Cap (MMBtu)	Approved VC O&M Cap ($)
1	N/A	19	10	N/A	190	17	207	N/A	N/A
2	N/A	21	10	N/A	210	20	230	N/A	N/A
3	N/A	18	10	N/A	180	14	194	N/A	N/A
4	N/A	15	10	N/A	150	15	165	N/A	N/A
5	300							21	20
6	130								130
7	200								200

[VCMRR005: Replace Table 4 above with the following upon system implementation of NPRR664:]

Resource	PPA Cost ($/MWh)	Fuel at LSL (MMBtu/MWhr)	Average $FIPR_r$ over the last 30 days ($/MMBtu)	Resource Fuel MMBtu/MWh = PPA Cost/$FIPR_r$	Resource Fuel Cost ($/MWh) = Fuel x $FIPR_r$	O&M ($/MWh)	Total Cost ($/MWh) Fuel +O&M	Approved VC Fuel Cap (MMBtu)	Approved VC O&M Cap ($)
1	N/A	19	10	N/A	190	17	207	N/A	N/A
2	N/A	21	10	N/A	210	20	230	N/A	N/A
3	N/A	18	10	N/A	180	14	194	N/A	N/A
4	N/A	15	10	N/A	150	15	165	N/A	N/A
5	300							21	20
6	130								130
7	200								200

Table 4 demonstrates the calculation of the Cap for Minimum Energy @ LSL when the verifiable costs submitted by the QSE representing the PPA include only a single cost. In this Table the verifiable total costs are shown for Non-PPA units 1 through 4. The highest of these is Unit 2 with a total verifiable cost of $230/MWh which becomes the Cap for the PPA units 5, 6 and 7. As before, if the costs of the PPA units are more than the Cap, the fuel and O&M components for the PPA Resource are set equal to the same components in the Reference Resource (Resource 2). In cases where the PPA submitted costs are less than those of the Reference Resource, the verifiable costs will be treated as O&M only and will not have a fuel component.

Example 2: PPAs indicating both Fuel and O&M costs

Example 2 below demonstrates the calculation of the PPA Cap when the PPA verifiable cost filing by the QSE representing the PPA includes fuel and O&M costs stated separately. The Cap for the PPAs is set by calculating the total O&M cost for the set of similar units and choosing the highest of those as the Cap. This example also shows (Table 5) how ERCOT is going to determine the Reference Resource and the PPA cap for operations above LSL.

Table 1: Cold Start-Up Cost for Simple Cycle > 90 MW Resources

Note: Units 5, 6 and 7 are under a PPA, therefore, their O&M are capped

Cold Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Fuel to LSL (MMBtu)	N/A	N/A	N/A	N/A	120	80	140
Total O&M Cost ($)	8,700	7,000	6,000	9,000	7,000	8,000	10,000
Approved VC Fuel (MMBtu)	N/A	N/A	N/A	N/A	120	80	140
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	7,000	8,000	9,000

In Table 1 above, the Cap is established by Unit 4 at $9,000. Of the three PPA Resources, only unit 7 is higher than the Cap at $10,000. Thus the verifiable O&M cost for PPA Unit 7 is set at $9,000 since Unit 4 establishes the O&M cap.

Table 2: Hot Start-Up Cost for Simple Cycle > 90 MW Resources

Hot Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Fuel to LSL (MMBtu)	N/A	N/A	N/A	N/A	55	80	90
Total O&M Cost ($)	6,000	4,000	3,500	6,000	5,000	5,900	8,000
Approved VC Fuel (MMBtu)	N/A	N/A	N/A	N/A	55	80	90
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	5,000	5,900	6,000

The same principle applies in Table 2. The PPA costs are capped by Unit 1. As in Table 1, the O&M costs for the Unit establishing the Cap are applied to the PPA units which submitted higher total O&M costs than the Cap.

Table 3: Intermediate Start-Up Cost for Simple Cycle > 90 MW Resources

Inter Type	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Fuel to LSL (MMBtu)	N/A	N/A	N/A	N/A	100	65	120
Total O&M Cost ($)	6,700	7,000	4,500	7,000	6,500	7,000	8,000
Approved VC Fuel (MMBtu)	N/A	N/A	N/A	N/A	100	65	120
Approved VC O&M Cap ($)	N/A	N/A	N/A	N/A	6,500	7,000	7,000

In Table 3 the PPA costs are capped by Unit 4. As in Table 1, the O&M costs for the Unit establishing the Cap are applied to the PPA units which submitted higher total costs than the Cap.

Table 4: Minimum Energy {@ LSL} PPA Cap for Simple Cycle > 90MW Resources

Resource	HSL (MW)	Fuel at LSL (MMBtu/MWhr)	O&M ($/MWh)	Approved VC Fuel ($/MWh)(1)	Approved VC O&M ($/MWh)(1)
1	300		17		
2	250		20		
3	280		14		
4	320		15		
5	290	25	25	25	20
6	310	30	21	30	20
7	300	15	19	15	19

(1) Approved VC = Minimum {Highest O&M without PPA or O&M with PPA}

Table 4 contains an example for the calculation of the Cap for Minimum Energy Cost @ LSL when the QSE submits verifiable costs which include both fuel and O&M costs. In this example, the highest Total O&M Cost for the non-PPA Resources is that for Resource 2 at $20/MWh. There are two PPAs (Resources 5 & 6) which have total submitted costs greater than this calculated Cap. The verifiable O&M costs components for these capped PPAs will be set equal to those components in Reference Resource 2.

Table 5: Costs for Operation Above LSL, PPA Cap for Simple Cycle > 90MW Resources (This cost is optional)

Resource	Average(1) O&M ($/MWh)	Approved VC O&M ($/MWh)
1	17	
2	20	
3	14	
4	15	
5	25	20
6	21	20
7	19	19

(1) Simple average for all of the (MMBtu/MWh versus MW) pairs along the IHR curve

Example 3: PPAs indicating only one (1) cost for the Resource; no fuel volume shown and no Reference Unit available

Table 1: Test for Reference Unit

Simple Cycle > 90 MW Resources

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5 (with PPA)
HSL	200	210	180	160	250
HSL Difference(1)	50%	40%	70%	90%	
Initial Commercial Operation Date	1996	2005	2006	2000	1990
Differences in years between PPA and non-PPA Resources	6	15	16	10	
Meets Criteria(2)	No	No	No	No	

(1) Percent difference with respect to unit with PPA

(2) Criteria: HSL difference +- 30% and year less than or equal to 5 years

Table 2: Cold, Hot, and Intermediate Start-Up Cost for Simple Cycle > 90 MW Resources

Cold Type	Unit 5
PPA Cost ($)	6,000
Approved VC Fuel (MMBtu)	N/A
Generic O&M ($)	5,000
Approved VC O&M Cap ($)	5,000

Hot Type	Unit 5
PPA Cost ($)	4,500
Approved VC Fuel (MMBtu)	N/A
Generic O&M ($)	5,000
Approved VC O&M Cap ($)	4,500

Inter Type	Unit 5
PPA Cost ($)	3,000
Approved VC Fuel (MMBtu)	N/A
Generic O&M ($)	5,000
Approved VC O&M Cap ($)	3,000

Since there is no Reference Resource, the approved verifiable costs will be set at the minimum of the PPA costs or the Generic O&M costs set forth in the Protocols.

Table 3: Minimum Energy {@ LSL} PPA Cap for Simple Cycle > 90MW Resources

Resource	PPA Cost ($/MWh)	Generic Fuel at LSL (MMBtu/MWhr)	Approved VC Fuel (MMBtu/MWh)	Approved VC O&M Cap ($)
1				
2				
3				
4				
5	300	15	15	0
6	140	15	15	0
7	200	15	15	0

In this example the submitted PPA costs for Units 6 and 7 were equal to or exceeded the Generic fuel costs and were therefore capped and approved at the Generic level. Since Generic costs at LSL do not include an O&M component, PPA Resources cannot received any O&M costs and their fuel rate is capped at Generic values.

Example 4: PPAs indicating both Fuel and O&M costs but without a Reference Unit

Table 1: Cold, Hot, and Intermediate Start-Up Cost for Simple Cycle > 90 MW Resources

Cold Type	Unit 5
Fuel to LSL (MMBtu)	120
Total O&M Cost ($)	7,000
Generic O&M ($)	5,000
Approved VC Fuel (MMBtu)	120
Approved VC O&M Cap ($)	5,000

Hot Type	Unit 5
Fuel to LSL (MMBtu)	55
Total O&M Cost ($)	5,000
Generic O&M ($)	5,000
Approved VC Fuel (MMBtu)	55
Approved VC O&M Cap ($)	5,000

Inter Type	Unit 5
Fuel to LSL (MMBtu)	100
Total O&M Cost ($)	6,500
Generic O&M ($)	5,000
Approved VC Fuel (MMBtu)	100
Approved VC O&M Cap ($)	5,000

Table 2: Minimum Energy {@ LSL} PPA Cap for Simple Cycle > 90MW Resources

Resource	O&M ($/MWh)	Fuel at LSL (MMBtu/MWhr)	Approved VC Fuel (MMBtu/MWh)	Approved VC O&M Cap ($)
1				
2				
3				
4				
5	15	25	25	0
6	14	30	30	0
7	18	15	15	0

In Table 2 above, Resources 5, 6 and 7 provided O&M costs and fuel rate at LSL, however, ERCOT did not approve the O&M costs since there were no Reference Units and no additional documentation was provided

Appendix 4: Operating and Maintenance Cost Categories

Maintenance Cost Categories

Maintenance Costs that fall within the categories listed in NERC's Data Reporting Instructions or as shown in Tables 4-6 below may be included as a Resource's Verifiable Maintenance Costs. Submitted Maintenance Costs may include a reference to an appropriate GADS Code. Additionally, submitted maintenance costs will only be approved to the extent that they comply with all other relevant provisions within this Manual. This means, for example, fixed maintenance costs, maintenance costs which cannot be verified, and *Event Specific Verifiable Maintenance Costs* will not be approved, even if they fall within a GADS category.

NERC's Data Reporting Instructions with an effective date of January 2007 may be found at the following link:
ftp://www.nerc.com/pub/sys/all_updl/gads/dri/2007_GADS_DRI.pdf

Currently, the Data Reporting Instructions may be found by following these steps:

Step 1: Connect to www.nerc.com
Step 2: From the drop down menu, choose GADS Services
Step 3: From the title menu, select Data Reporting Instructions
Step 4: Choose Appendix B1-B9

Operating Cost Categories

Other permissible categories of Operating Costs are listed tables 4-6 below. Additionally, submitted Operating Costs will only be approved to the extent that they comply with all other relevant provisions within this Manual.

Table 4: O&M Categories applicable to all generating plants

1. Water consumption in plant operations.
2. Emission credits.
3. Incremental operating labor.
4. Auxiliary equipment repair.
5. Replacement of consumables and normal wear-and-tear items (e.g., seals, lockplates, nuts, bolts, gaskets, etc.).
6. Mechanical parts replacement.
7. On-line running maintenance.
8. Performance testing.
9. Vibration analysis monitoring.
10. Waste water treatment.
11. Auxiliary equipment maintenance.
12. Filter changes.
13. Oil changes.
14. Oil and water level checks.
15. Condensate Pump Inspection and Overhaul.
16. Circulation Pump Inspection and Overhaul.
17. Replacement of Cooling Tower Fill and Drift Eliminators.

18. Steam Turbine Generator inspection.
19. Preventive maintenance tests.
20. Auxiliary power consumption.
21. Auxiliary fuels/lubricants.
22. Compressor and turbine rotors inspection.
23. Minor Generators repairs.
24. Fuel metering equipment replacement.
25. Gas turbine auxiliaries.
26. Controls and accessories replacement.
27. Pre-air heater test.
28. Transformer maintenance.
29. Relay cleaning.
30. Battery system service.
31. Oxygen boiler test.
32. Condenser inspections.
33. Condenser cleaning.
34. Water demineralization and treatment.
35. On-line performance testing.
36. Condenser tube cleaning.
37. Boiler tube repair resulting from cycling operations.
38. Generator field rewinds.
39. Stop valve inspection.
40. Control valve inspection.
41. Boiler casing leak repair (where applicable).

Table 5: O&M Categories applicable to Coal-Fired Generating Plants

1. Boiler safety valve testing
2. Steam drum repairs
3. Water wall repairs
4. Seals replacement
5. Coal hopper repair
6. Coal crusher repair
7. Coal freeze proofing
8. Chemical cleaning of internal heating surfaces
9. Repair or stud surfaces
10. Evaporator tubing repairs
11. Superheater and reheater tubing and headers repairs
12. Heat exchanger cleaning
13. Conveyor belt repair
14. Coal drying
15. Coal-handling and distribution equipment repair
16. Stack, fans and draft repair
17. Seal welding of tubes
18. Coal pulverizing equipment repair

Table 6: O&M Categories applicable to Combustion Turbine/Combined-Cycle Generating Plants

1. Alignment check of the gas turbine to the generator, as well as of the gas turbine to the accessory gear.
2. BFW Pump Inspection and Overhaul.
3. Borescope inspections of compressor casings and turbine shells.
4. Casings, shells, and frames/diffusers inspected for cracks and erosion.

5. Checks of alignment between gas turbine and generator; gas turbine and accessory gear.
6. Radial and axial clearances check.
7. Seals for rubs and deterioration of clearance checks.
8. Device calibrations check.
9. Chemical Cleaning or Hydro-Blasting of Heat Transfer Surfaces.
10. Fluorescent penetrant inspection of bucket vane sections.
11. Combustion Turbine Generator Evaporative cooling system media replacement.
12. Combustion Turbine Generator Inspections.
13. Compressor inlet and flow-path inspection for fouling, erosion, corrosion, and leakage.
14. Cooling Tower Fan Motor and Gearbox Inspection and Overhaul.
15. Compressor wash systems repair.
16. Distillate Fuel Pumps Inspection and Overhaul.
17. Electric generator inspection and overhaul.
18. Environmental: SCR replacement.
19. Evaporative cooling system media.
20. Inlet Air Filter Replacement.
21. Inspection of bearing liners and seals for clearance and wear.
22. Buckets inspection.
23. Fuel Gas Compressors Inspection and Overhaul.
24. Fuel System replacement.
25. Heat Transfer Surface Replacements.
26. Inspection of compressor blades for rubs.
27. Hydrogen embrittlement testing.
28. Inspection of flow sleeve welds for cracking.
29. Inspection of fuel nozzles for plugging and erosion of tip holes.
30. Detectors, combustor flow sleeves, flow sleeve welds, combustion system and discharge casing.
31. Maintenance of fuel treatment system.
32. Mechanical inlet air cooling chiller and pump inspection and overhaul.
33. Sampling of turbine lube oil for viscosity, chemical composition, contamination, particulate, and water-contamination.
34. Water Treatment: Resin Replacement.
35. Impact damage, corrosion, and buildup of deposits.
36. Inspection of cross-fire tube, retainer, and combustion liner for cracking, oxidation, corrosion, and erosion.
37. Inspection of fluid, air, and gas passages in the nozzle assembly for plugging, erosion, corrosion, etc.
38. Inspection of fuel nozzles, liners, transition pieces, crossfire tubes and retainers, spark plug assemblies, flame.
39. Inspection of inlet systems for corrosion, cracked silencers, and loose parts.
40. Maintenance of inlet filtration systems and inlet evaporative coolers for compressors.
41. Refurbishing bucket coatings.
42. Turning and ratchet gear maintenance.
43. Water Treatment: RO Cartridges Replacement.
44. Inspection of combustion chamber interior.
45. Inspection of fuel nozzles.

46. Inspection of spark plug assembly.
47. Inspection of later-stage diaphragm packing.
48. Inspection of bucket seals for clearances, rubs, and deterioration.
49. Inspection of turbine stationary shrouds.
50. Inspection of wheelspace instrumentation.
51. Inspection of variable inlet guide vanes (VIGVs).
52. Repair and refurbishment of second and third-stage nozzles.
53. Recoating of turbine buckets.
54. Replacement or refurbishment of hot gas parts.

Appendix 5: Specification of Relevant Equations

Equation 1: Verifiable Start-up Offer Cap (Hot Start) ($/Start)

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

Where: AFCRS[(1)] = the adjusted verified fuel consumption for a hot start (MMBtu/Startup)
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 ($/Startup)

(1) Adjusted by the PHR and VOX (see appendix 6)

And: AFCRS= (verified fuel consumption-PHR fuel rate value)*(1+VOX)

See Market Bulletin 10-01 VC Adjustments for additional details
http://www.ercot.com/feed/show_rss.rxml?feed=mobs

Similar equations apply for Verifiable Cold and Intermediate Startup Offer Caps

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.

[VCMRR005: Replace Equation 1 above with the following upon system implementation of NPRR664:]

Equation 1: Verifiable Start-up Offer Cap (Hot Start) ($/Start)

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

Where: AFCRS[(1)] = the adjusted verified fuel consumption for a hot start (MMBtu/Startup)
GASPERSU = Percentage of natural gas used for a start
$FIPR_r$ = Fuel Index Price for Resource ($/MMBtu)
OILPERSU = Percentage of oil used for a start
FOP = Fuel Oil Price ($/MMBtu)
VOMS = the verified O&M cost for a hot start ($/Startup)

(1) Adjusted by the PHR and VOX (see appendix 6)

And: AFCRS= (verified fuel consumption-PHR fuel rate value)*(1+VOX)

See Market Bulletin 10-01 VC Adjustments for additional details
http://www.ercot.com/feed/show_rss.rxml?feed=mobs

Similar equations apply for Verifiable Cold and Intermediate Startup Offer Caps

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.

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 VOX

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

See Market Bulletin 10-01 VC Adjustments for additional details
http://www.ercot.com/feed/show_rss.rxml?feed=mobs

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.

[VCMRR005: Replace Equation 2 above with the following upon system implementation of NPRR664:]

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

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

Where: AHR[(1)]= Fuel Rate (MMBtu/Hour) divided by LSL (MW)
GASPERME = Percentage of natural gas used at LSL
$FIPR_r$ = Fuel Index Price for Resource ($/MMBtu)
OILPERME = Percentage of oil used at LSL
FOP = Fuel Oil Price ($/MMBtu)
VOMLSL = the verified O&M cost at Minimum-Energy ($/MWh)

(1) Adjusted by VOX

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

See Market Bulletin 10-01 VC Adjustments for additional details
http://www.ercot.com/feed/show_rss.rxml?feed=mobs

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.

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) = AFCRS * ∑Emission Rate i * Emission Cost Index i

Where AFCRS = Quantity of adjusted 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 Index i = Published cost index of emission i ($/lb)
i = Index for each emittent approved for inclusion in Startup Cost

See Market Bulletin 10-01 VC Adjustments for additional details
http://www.ercot.com/feed/show_rss.rxml?feed=mobs

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

Emission Rate i = Quantity of emission i emitted by resource (lbs/MMBtu)
Emission Cost Index i = Published cost index of emission i
i = Index of each emittent approved for inclusion in Minimum-Energy Cost

See Market Bulletin 10-01 VC Adjustments for additional details
http://www.ercot.com/feed/show_rss.rxml?feed=mobs

Equation 6: Equation for Calculation of Verifiable Startup Costs (VERISU) ($/Start)

VERISU = AFCRS + VOMS

Where VERISU = Verifiable Startup Costs
AFCRS= Verifiable Startup Fuel Costs ($/Start)
VOMS = Verifiable Operations and Maintenance Costs ($/Startup)

$AFCRS = [Fuel_{Startup\text{-}BC} + Fuel_{BC\text{-}LSL} + Fuel_{BO\text{-}Shutdown}] * [FIP*GASPERSU(\%) + FOP*OILPERSU(\%) + SFP*SFPERSU(\%)]$

Where $Fuel_{Startup\text{-}BC}$ = Adjusted Fuel Quantity required to bring Resource from Startup to Breaker Close (MMBtu)
$Fuel_{BC\text{-}LSL}$ = Adjusted Fuel Quantity required to bring Resource from Breaker Close to Minimum Energy at LSL (MMBtu)
$Fuel_{BO\text{-}Shutdown}$ = Adjusted Fuel Quantity required to take Resource from Breaker Open to Shutdown (MMBtu)
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

$VOMS = IO\&M_{Start\text{-}LSL} + IO\&M_{BO\text{-}Shutdown}$ + Verifiable Startup Emission Costs

Where $IO\&M_{Start\text{-}LSL}$ = Incremental O&M costs incurred to bring Resource from Start to LSL ($/Start)

$IO\&M_{BO\text{-}Shutdown}$ = 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 .

[VCMRR005: Replace Equation 6 above with the following upon system implementation of NPRR664:]

Equation 6: Equation for Calculation of Verifiable Startup Costs (VERISU) ($/Start)

$VERISU = AFCRS + VOMS$

Where VERISU = Verifiable Startup Costs
AFCRS= Verifiable Startup Fuel Costs ($/Start)
VOMS = Verifiable Operations and Maintenance Costs ($/Startup)

$AFCRS = [Fuel_{Startup\text{-}BC} + Fuel_{BC\text{-}LSL} + Fuel_{BO\text{-}Shutdown}] * [FIPR_r*GASPERSU(\%) + FOP*OILPERSU(\%) + SFP*SFPERSU(\%)]$

Where $Fuel_{Startup\text{-}BC}$ = Adjusted Fuel Quantity required to bring Resource from Startup to Breaker Close (MMBtu)
$Fuel_{BC\text{-}LSL}$ = Adjusted Fuel Quantity required to bring Resource from Breaker Close to Minimum Energy at LSL (MMBtu)
$Fuel_{BO\text{-}Shutdown}$ = Adjusted Fuel Quantity required to take Resource from Breaker Open to Shutdown (MMBtu)
$FIPR_r$= Fuel Index Price for Resource ($/MMBtu)
FOP = Fuel Price Index for oil ($/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

$VOMS = IO\&M_{Start\text{-}LSL} + IO\&M_{BO\text{-}Shutdown}$ + Verifiable Startup Emission Costs

Where $IO\&M_{Start\text{-}LSL}$ = Incremental O&M costs incurred to bring Resource from Start to LSL ($/Start)
$IO\&M_{BO\text{-}Shutdown}$ = 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 = $IO\&M_{LSL}$ + Verifiable Emission Costs at Minimum Energy
Where $IO\&M_{LSL}$ = 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.

[VCMRR005: Replace Equation 7 above with the following upon system implementation of NPRR664:]

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)] * [$FIPR_r$*GASPERME(%) + FOP*OILPERME(%) + SFP*SFPERME(%)]

Where AHR = Adjusted average heat rate at Minimum Energy (MMBtu/Hr)
$FIPR_r$ = Fuel Index Price for Resource ($/MMBtu)
FOP = Fuel Price Index for oil ($/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 = $IO\&M_{LSL}$ + Verifiable Emission Costs at Minimum Energy
Where $IO\&M_{LSL}$ = 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.

Appendix 6: Calculation and Application of Proxy Heat Rate and the Value of X

Proxy Heat Rate (MMBtu/MWh) = Average (based on values for one standard deviation from the Arithmetic Mean) ERCOT Day-Ahead Hub Price (in period) (DASPP $_{ERCOT345BUS}$)/Average Fuel Price Index (FIP)($/MMBtu) for the same period. The PHR shall be based on the minimum of a 12 month rolling average or all available PHR values. The value of X (VOX) = $0.50/ Average Fuel Price Index (FIP) ($/MMBtu) (in period).

[VCMRR005: Replace the paragraph above with the following upon system implementation of NPRR664:]

Proxy Heat Rate (MMBtu/MWh) = Average (based on values for one standard deviation from the Arithmetic Mean) ERCOT Day-Ahead Hub Price (in period) (DASPP $_{ERCOT345BUS}$)/Average Fuel Index Price for Resource ($FIPR_r$)($/MMBtu) for the same period. The PHR shall be based on the minimum of a 12 month rolling average or all available PHR values. The value of X (VOX) = $0.50/ Average Fuel Index Price for Resource ($FIPR_r$) ($/MMBtu) (in period).

The PHR is used to estimate the payments received in Real Time by Resources ramping from breaker close to LSL (see Appendix 5 for additional details). These estimated payments are removed from the RUC Guarantee indirectly by subtracting the product of the PHR and average generation (from breaker close to LSL) from the Resource's approved fuel rate, which is used to establish the RUC Guarantee.

The value of X (VOX) is used to compensate Resources for the actual cost of transporting and purchasing spot fuel for the calculation of Mitigated Offer Caps and when they receive RUC instructions. VOX = Fuel Adder ($/MMBtu) / Average Fuel Index Price (FIP) ($/MMBtu) (in a 15 day period – see item 2 below). The product of the fuel rate and VOX is added to the approved fuel rate values for each of Startup Fuel, minimum energy heat rate, and incremental energy heat rate.

[VCMRR005: Replace the paragraph above with the following upon system implementation of NPRR664:]

The value of X (VOX) is used to compensate Resources for the actual cost of transporting and purchasing spot fuel for the calculation of Mitigated Offer Caps and when they receive RUC instructions. VOX = Fuel Adder ($/MMBtu) / Average Fuel Index Price for Resource ($FIPR_r$) ($/MMBtu) (in a 15 day period – see item 2 below). The product of the fuel rate and VOX is added to the approved fuel rate values for each of Startup Fuel, minimum energy heat rate, and incremental energy heat rate.

For additional information on the fuel adder, see Section 3, Verifiable Startup Costs – Submitting Startup Costs – Adjustments to Verified Startup Fuel Consumption – Additional Rules for Submitting Fuel Costs.

1. The effective period for changing a Resource fuel rate by the PHR and VOX is the first day of each month through the end of the same month.

2. The period for calculating the PHR and VOX is the first 15 days of the month prior to the effective month.

3. ERCOT shall calculate the new fuel rate values using the PHR and VOX and publish the results for PHR 8 days prior to the first day of each effective month.

4. ERCOT publishes the PHR on the Market Information System (MIS) Public Area and on the MIS Public reference Data Extract (PRDE).

Appendix 7: Calculation of the Variable O&M Value and Incremental Heat Rate used in Real Time Mitigation for Quick Start Generation Resources (QSGRs)

Variable O&M rate ($/MWh) = Variable O&M (above LSL) + Startup Costs ($) / G (MWh)

Where

Variable O&M (above LSL) = approved Variable O&M above LSL if filed in a resources verifiable costs filing or 0 if not filed.

Startup Costs = Startup O&M Cost + Startup Fuel Cost

Startup O&M Cost = Approved Startup O&M Costs in a cold start position (Verified (QSGR mode) or Standard) or Resource Specific Generic Startup O&M Costs

Startup Fuel Cost = 90% of Approved Startup Fuel in a cold start position (MMBtu) adjusted by VOX as described in Appendix 6, multiplied by the Average Fuel Index Price in the period used in the VOX Calculation ($/MMBtu)

G = average generation during Minimum up time (MWh)

Where

G (MWh) = 75% * HSL (MW) * L (Hr)

and

HSL (MW) = average of the seasonal HSL in the RARF

L = Max {RARF Min Up Time, Average number of running hours in period, or 2} (hr)

Where:

Average number of running hours in period = 75% of the average run time over the past 20 days for electrical and physically similar QSGRs at the same plant site.

The equation for calculating Variable O&M rate for QSGR in the MOC is as follows:

Variable O&M rate ($/MWh) = Variable O&M (above LSL) + Startup Costs ($) / {75% * HSL (MW) * L (Hr)}

[VCMRR005: Replace the equation above with the following upon system implementation of NPRR664:]

Variable O&M rate ($/MWh) = Variable O&M (above LSL) + Startup Costs ($) / G (MWh)

Where

Variable O&M (above LSL) = approved Variable O&M above LSL if filed in a resources verifiable costs filing or 0 if not filed.

Startup Costs = Startup O&M Cost + Startup Fuel Cost

Startup O&M Cost = Approved Startup O&M Costs in a cold start position (Verified (QSGR mode) or Standard) or Resource Specific Generic Startup O&M Costs

Startup Fuel Cost = 90% of Approved Startup Fuel in a cold start position (MMBtu) adjusted by VOX as described in Appendix 6, multiplied by the Average Fuel Index Price for Resource ($FIPR_r$) in the period used in the VOX Calculation ($/MMBtu)

G = average generation during Minimum up time (MWh)

Where

G (MWh) = 75% * HSL (MW) * L (Hr)

and

HSL (MW) = average of the seasonal HSL in the RARF

L = Max {RARF Min Up Time, Average number of running hours in period, or 2} (hr)

Where:

Average number of running hours in period = 75% of the average run time over the past 20 days for electrical and physically similar QSGRs at the same plant site.

The equation for calculating Variable O&M rate for QSGR in the MOC is as follows:

Variable O&M rate ($/MWh) = Variable O&M (above LSL) + Startup Costs ($) / {75% * HSL (MW) * L (Hr)}

Adj. Incremental Heat Rate$_p$ (MMBtu/MWh) = (Incremental Heat rate$_p$ + Minimum Energy Component) and adjusted by VOX method described in Appendix 6

Where

Incremental Heat rate$_p$ (IHR$_p$) = approved incremental heat rate (IHR) points file in the resource verifiable cost filing or the generic IHR in the Protocols

Where:

$_p$ = number of incremental heat rate point pairs (i.e. MW and IHR) used to describe the cost of the next MW of generation

Minimum Energy Component (MEC) = the difference between the Average Heat Rate (AHR) and the Incremental Heat Rate (IHR) at the Midpoint of the QSGR Dispatch Range. These heat rate values shall be based on the values provided in the resource verifiable cost filing or 0 if the resource has not filed for verifiable costs.

Where:

Midpoint of QSGR Dispatch Range (MDR) = HSL - (HSL – LSL) * 50%

$MEC = AHR_{@MDR} - IHR_{@MDR}$

The equation for calculating Adj. Incremental Heat Rate for QSGR used in the MOC calculations is as follows:

Adj. Incremental Heat Rate$_p$ (MMBtu/MWh) = IHR$_p$ + MEC + (IHR$_p$ + MEC) * VOX

Sample Calculation

- HSL = 70 MW
- Start O&M = $1,505/Start
- Start Fuel = 100 MMBtu
- Variable O&M (above LSL) = $1.5/MWh
- RARF Min Up Time = 1 hour
- Actual Run Time = 1 hour

- Fuel Index Price (FIP) = $5/MMBtu
- Resource fuel adder = $0.50/MMBtu
- IHR = 10 MMBtu/MWh
- MEC = 2.5 MMBtu/MWh
- VOX = $0.50/MMBtu / $5.00/MMBtu = 0.1

Start Fuel adjusted for energy produced during startup = Start Fuel * 90%

Therefore to determine Variable O&M rate:

Variable O&M rate ($/MWh) = Variable O&M (above LSL) + Startup Costs ($) / {75% * HSL (MW) * L (Hr)}

- Startup costs = $1,505 + (100 MMBtu +(100 MMBtu* 0.1)) * 90% * $5/MMBtu

  =$1,505 + (110 MMBtu) * 90% * $5/MMBtu

  =$1,505 + $495 = $2,000

- L = Max {RARF Min Up Time, Average number of running hours in period, or 2} (hr)

  = Max{1, 1, 2} = 2

- Variable O&M rate ($/MWh) = $1.50/MWh + $2,000 / (75% * 70 * 2)
  = $ 20.55/MWh

And to calculate Incremental Heat Rate for one point:

Adj. Incremental Heat Rate$_p$ (MMBtu/MWh) = IHR$_p$ + MEC + (IHR$_p$ + MEC) * VOX

- IHR$_{p1}$ = 10 MMBtu/MWh + 2.5 MMBtu/MWh + (10 MMBtu/MWh + 2.5 MMBtu/MWh) * 0.1

  = 12.5 MMBtu/MWh+(12.5 MMBtu/MWh)*.1)

  = 13.75 MMBtu/MWh

Therefore the Mitigated Offer Cap (MOC) calculations are as follows:

MOC ($/MWh) = ($IHR_p$ * FIP + Variable O&M rate) * W

Where

- W = Capacity Factor Multiplier (range of multipliers defined in Protocol Section 4.4.9.4.1 Mitigated Offer Cap) = 1.40

- MOC = (13.75 MMBtu/MWh * $5/MMBtu + $20.55/MWh) * 1.4

  = ($68.75/MWh + $20.55/MWh) * 1.4

  = ($89.30) * 1.4 = $125.02/MWh

[VCMRR005: Replace the sample calculation above with the following upon system implementation of NPRR664:]

Sample Calculation

- HSL = 70 MW
- Start O&M = $1,505/Start
- Start Fuel = 100 MMBtu
- Variable O&M (above LSL) = $1.5/MWh
- RARF Min Up Time = 1 hour
- Actual Run Time = 1 hour
- Average Fuel Index Price for Resource ($FIPR_r$) = $5/MMBtu
- Resource fuel adder = $0.50/MMBtu
- IHR = 10 MMBtu/MWh
- MEC = 2.5 MMBtu/MWh
- VOX = $0.50/MMBtu / $5.00/MMBtu = 0.1

Start Fuel adjusted for energy produced during startup = Start Fuel * 90%

Therefore to determine Variable O&M rate:

Variable O&M rate ($/MWh) = Variable O&M (above LSL) + Startup Costs ($) / {75% * HSL (MW) * L (Hr)}

- Startup costs = $1,505 + (100 MMBtu +(100 MMBtu* 0.1)) * 90% * $5/MMBtu

  =$1,505 + (110 MMBtu) * 90% * $5/MMBtu

  =$1,505 + $495 = $2,000

- L = Max {RARF Min Up Time, Average number of running hours in period, or 2} (hr)

  = Max{1, 1, 2} = 2

- Variable O&M rate ($/MWh) = $1.50/MWh + $2,000 / (75% * 70 * 2)
  = $ 20.55/MWh

And to calculate Incremental Heat Rate for one point:

Adj. Incremental Heat Rate$_p$ (MMBtu/MWh) = IHR$_p$ + MEC + (IHR$_p$ + MEC) * VOX

- IHR$_{p1}$ = 10 MMBtu/MWh + 2.5 MMBtu/MWh + (10 MMBtu/MWh + 2.5 MMBtu/MWh) * 0.1

  = 12.5 MMBtu/MWh+(12.5 MMBtu/MWh)*.1)

  = 13.75 MMBtu/MWh

Therefore the Mitigated Offer Cap (MOC) calculations are as follows:

MOC ($/MWh) = (IHR$_p$ * FIPR$_r$ + Variable O&M rate) * W

Where

- W = Capacity Factor Multiplier (range of multipliers defined in Protocol Section 4.4.9.4.1 Mitigated Offer Cap) = 1.40

- MOC = (13.75 MMBtu/MWh * $5/MMBtu + $20.55/MWh) * 1.4

  = ($68.75/MWh + $20.55/MWh) * 1.4

  = ($89.30) * 1.4 = $125.02/MWh

Appendix 8: Procedure for evaluating actual fuel prices for Reliability Unit Commitments (RUC)

Description

Per Nodal Protocol Section 9.14.7, QSEs may recover the actual price of fuel paid for providing a Reliability Unit Commitment (RUC) if the actual fuel price is higher than FIP (or FOP) plus VOX. This procedure describes the methodology ERCOT will use to determine the startup price (SUPR) and Minimum-Energy Price (MEPR) for such disputes.

[VCMRR005: Replace the paragraph above with the following upon system implementation of NPRR664:]

Per Nodal Protocol Section 9.14.7, QSEs may recover the actual price of fuel paid for providing a Reliability Unit Commitment (RUC) if the actual fuel price is higher than $FIPR_r$ (or FOP) plus VOX. This procedure describes the methodology ERCOT will use to determine the startup price (SUPR) and Minimum-Energy Price (MEPR) for such disputes.

Procedure

There are four possible scenarios that may arise from QSEs disputing additional fuel compensation.

1. Resource has no approved Verifiable Costs nor approved Offers
2. Resource has no approved Verifiable Costs with approved Offers
3. Resource has approved Verifiable Costs but no approved Offers
4. Resource has Approved Verifiable Costs and approved Offers

Scenario 1: Resource has no approved Verifiable Costs nor approved Offers

SUPR

Since the Resource has no verifiable costs approved, there is no fuel rate value to calculate the cost of fuel. SUPR = 0

MEPR

MEPR ($/MWh) = $HR_{Generic}$ * AFPrice

Where,

$HR_{Generic}$ = Generic Heat Rate for the technology type as defined in Section 4.4.9.2.3 (2)

AFPrice = Actual Fuel Price in $/MMBtu

Scenario 2: Resource has no approved Verifiable Costs with approved Offers

SUPR

Since the Resource has no verifiable costs approved, there is no fuel rate value to calculate the cost of fuel. SUPR = 0

MEPR

MEPR ($/MWh) = HR_{Offer} * AFPrice

Where,

HR_{Offer} = MEO / (FIP/FOP)

AFPrice = Actual Fuel Price in $/MMBtu

Note: The Heat Rate with the Offer (HR_{Offer}) is used instead of the Generic Heat Rate otherwise the Resource could be paid more than what it Offered. The maximum (Cap) Heat Rate value the QSE can submit with an Offer is the Generic Heat Rate. Therefore, ERCOT will calculate the HR with the Offer to establish the value of MEPR.

[VCMRR005: Replace Scenario 2 above with the following upon system implementation of NPRR664:]

Scenario 2: Resource has no approved Verifiable Costs with approved Offers

SUPR

Since the Resource has no verifiable costs approved, there is no fuel rate value to calculate the cost of fuel. SUPR = 0

MEPR

MEPR ($/MWh) = HR_{Offer} * AFPrice

Where,

HR_{Offer} = MEO / ($FIPR_r$/FOP)

AFPrice = Actual Fuel Price in $/MMBtu

Note: The Heat Rate with the Offer (HR_{Offer}) is used instead of the Generic Heat Rate otherwise the Resource could be paid more than what it Offered. The maximum (Cap) Heat Rate value the QSE can submit with an Offer is the Generic Heat Rate. Therefore, ERCOT will calculate the HR with the Offer to establish the value of MEPR.

Scenario 3: Resource has approved Verifiable Costs but no approved Offers

SUPR

SUPR ($) = VC Fuel * AFPrice + $O\&M_{VC}$

MEPR ($/MWh) = AHR_{VC} * AFPrice + $O\&M_{VC}$

Where,

VC Fuel = Approved and adjusted startup Fuel (adjusted by VOX)

$O\&M_{VC}$ = Approved verifiable O&M

AHR_{VC} = Approved and adjusted average Heat Rate at LSL (adjusted by VOX)

AFPrice = Actual Fuel Price in $/MMBtu

Scenario 4: Resource has approved Verifiable Costs and approved Offers

Offers < than Cap

When offers are less than the Cap, it is assumed that the QSE has used a lower O&M value to construct its Offers since it's unlikely a lower fuel rate or price was used.

Therefore,

$SUO = VC\ Fuel * FIP/FOP + O\&M_{New}$

Where,

VC Fuel = approved and adjusted fuel rate (adjusted by VOX)

SUO = startup offer submitted by QSE, and

$O\&M_{New} = Max\ (0, SUO_{q,r,s} - (VC\ Fuel * FIP/FOP))$

Or

SUO_{New} **($)** $= VC\ Fuel * AFPrice + O\&M_{New}$

Where,

SUO_{New} = new startup offer submitted by QSE, and

SUPR ($) = SUO_{New}

And

$MEO = HR_{VC} * FIP/FOP + O\&M_{New\text{-}LSL}$

Where,

HR_{VC} = approved and adjusted heat rate (adjusted by VOX)

MEO = Minimum Energy offer submitted by QSE, and

$O\&M_{New\text{-}LSL} = Max\ (0, MEO - VC\ Heat\ Rate * FIP/FOP)$

Then

$MEPR\ (\$/MWh) = HR_{VC} * AFPrice + O\&M_{New\text{-}LSL}$

If the Resource does not have approved O&M at Min Energy, then HR_{VC} is replaced with $HR_{Offer.}$

Or

$MEPR = HR_{Offer} * AFPrice$

Where,

$HR_{Offer} = MEO / (FIP/FOP)$

Offers = Cap

$SUPR = VC\ Fuel * AFPrice + O\&M_{VC}$

Where,

$O\&M_{VC}$ = Approved O&M

And

$MEPR = HR_{VC} * AFPrice$

[VCMRR005: Replace Scenario 4 above with the following upon system implementation of NPRR664:]

Scenario 4: Resource has approved Verifiable Costs and approved Offers

Offers < than Cap

When offers are less than the Cap, it is assumed that the QSE has used a lower O&M value to construct its Offers since it's unlikely a lower fuel rate or price was used.

Therefore,

$SUO = VC\ Fuel * FIPR_r/FOP + O\&M_{New}$

Where,

VC Fuel = approved and adjusted fuel rate (adjusted by VOX)

SUO = startup offer submitted by QSE, and

$O\&M_{New} = Max\ (0, SUO_{q,r,s} - (VC\ Fuel * FIPR_r/FOP))$

Or

SUO_{New} **($)** $= VC\ Fuel * AFPrice + O\&M_{New}$

Where,

SUO_{New} = new startup offer submitted by QSE, and

$SUPR\ (\$) = SUO_{New}$

And

$MEO = HR_{VC} * FIPR_r/FOP + O\&M_{New\text{-}LSL}$

Where,

HR_{VC} = approved and adjusted heat rate (adjusted by VOX)

MEO = Minimum Energy offer submitted by QSE, and

$O\&M_{New\text{-}LSL} = Max\ (0, MEO - VC\ Heat\ Rate * FIPR_r/FOP)$

Then

$MEPR\ (\$/MWh) = HR_{VC} * AFPrice + O\&M_{New\text{-}LSL}$

If the Resource does not have approved O&M at Min Energy, then HR_{VC} is replaced with $HR_{Offer.}$

Or

$MEPR = HR_{Offer} * AFPrice$

Where,

$HR_{Offer} = MEO / (FIPR_r/FOP)$

Offers = Cap

$SUPR = VC\ Fuel * AFPrice + O\&M_{VC}$

Where,

$O\&M_{VC}$ = Approved O&M

And

$MEPR = HR_{VC} * AFPrice + O\&M_{VC}$

[VCMRR005: Replace Appendix 9 below with the following upon system implementation of NPRR664:]

Appendix 9: Procedure for incorporating Variable O&M (VOM) for power augmentation techniques into the Mitigated Offer Cap (MOC)

Description

Resources using power augmentation techniques such as Peak or Duct Firing, Steam Injection and Air Cooled Condenser Fogging, may be subject to higher operations and maintenance costs, while these technologies are usually not part of the units normal operations. These incremental costs (and possibly changes to the heat rates) cannot be incorporated into the "normal" operating range of the Mitigated Offer Curve (MOC) due to current limitations in the ERCOT systems. As a result, the following procedure offers a manual option to include the VOM into the MOC until a system change is made to allow variations in the variable O&M.

General form of the Mitigated Offer Cap

Resources that are solving non-competitive solutions under Step 2 of SCED are mitigated based on the greater of the reference LMP at the appropriate Resource Node from Step 1 or the MOC. In general, the MOC is calculated as:

The greater of A or B (based on verifiable costs)

A. Generic Heat Rate x Fuel Price

B. [Incremental Heat Rate (IHR) x Fuel Price + VOM]* W

Where,

W = Factor as defined in paragraph (e) of Protocol Section 4.4.9.4.1, Mitigated Offer Cap.

<u>If the Resource has submitted an actual IHR (verifiable cost),</u>

1. $MOC = [IHR_i \times FIPR_r + VOM]^* W$

   Where, i = 1...10

   And $FIPR_r$ = Fuel Index Price for Resource

   And VOM = constant value along the IHR curve

<u>Including units of measurements</u>

2. MOC ($/MWh) = [$IHR_i$ (MMBtu/MWh) x $FIPR_r$ ($/MMBtu) + VOM ($/MWh)]* W

Including a VOM for power Augmentation

3. MOC ($/MWh) = [$IHR_i$ (MMBtu/MWh) x $FIPR_r$ ($/MMBtu) + VOM ($/MWh) + VOMP ($/MWh)]* W

   Where,

   VOM = average variable O&M for operations without power augmentation, and VOMP= corresponding variable O&M value for power augmentation technique (assuming only one power augmentation online)

Re-arranging equation 3

4. MOC ($/MWh) = [$IHR_i$ (MMBtu/MWh) + VOM ($/MWh)/ $FIPR_r$ ($/MMBtu) + VOMP ($/MWh)/ $FIPR_r$ ($/MMBtu)] * $FIPR_r$ ($/MMBtu) * W

   Or (and omitting the units)

5. MOC = [IHR_i + VOM / $FIPR_r$ + VOMP / $FIPR_r$] * $FIPR_r$ * W

   Note, the term VOMP / $FIPR_r$ is an implied heat rate (IMHR), or

6. MOC = [IHR_i + VOM / $FIPR_r$ + IMHR] *$FIPR_r$ * W

   And

7. **MOC = [(IHR_i + $IMHR_j$)*$FIPR_r$ + VOM]* W**

   Where,

   $IMHR_j$ = VOMP/ $FIPR_r$ avg, and **$_j$** = 10 (assuming power augmentation is added to the last point of the IHR curve as shown in Table 1 below.

   $FIPR_r$ avg = represents the average Fuel Index Price for Resource for the first two weeks of the month prior to the effective month. For example, the $FIPR_r$ avg for August is based on the average $FIPR_r$ price for period July 1- July 15.

Table 1: Summary

Point	MW	IHR	VOM	VOMP[a]	IMHR[b]	Final IHR	Final VOM
1	MW1	IHR1	VOM	Null	Null	IHR1	VOM

2	MW2	IHR2				IHR2	
3	MW3	IHR3				IHR3	
4	MW4	IHR4				IHR4	
5	MW5	IHR5				IHR5	
6	MW6	IHR6				IHR6	
7	MW7	IHR7				IHR7	
8	MW8	IHR8				IHR8	
9	MW9	IHR9				IHR9	
10	MW10	IHR10		VOMP	IMHR	IHR10+IMHR	

Power Augmentation operating range

[a] VOMP - Incremental variable cost above normal VOM

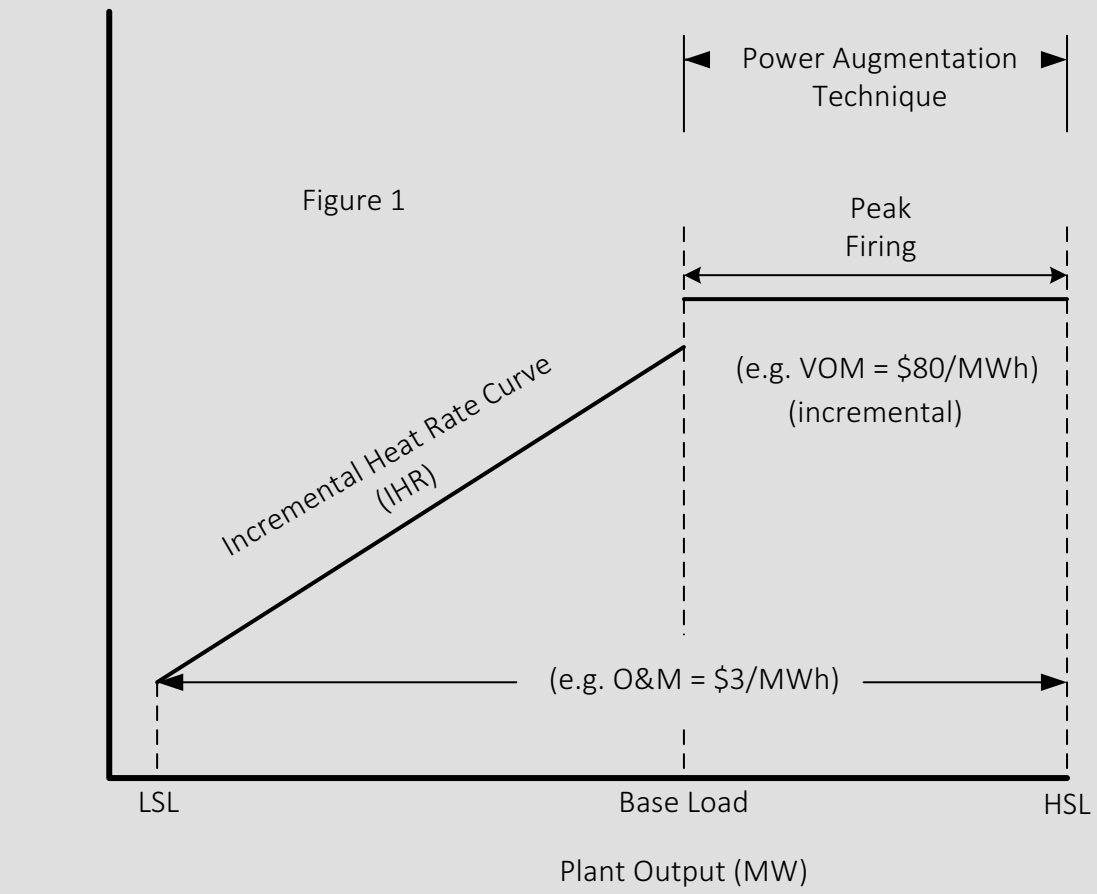
[b] IMHR = VOMP/$FIPR_r$ avg

Section 5 – Interim solution sample calculation

The following example provides an illustration of the manual calculation to incorporate the VOMP of a single power augmentation technique into the MOC.

Typical Power Augmentation Arrangement

Note: Assume the power augmentation block is 10MW and constant IHR equal to the last point on the curve without power augmentation.



Example using Figure 1

- HSL = 120MW (normal)
- $FIPR_r$ = $FIPR_r$ avg = $4/MMBtu
- VOM = $3/MWh
- VOMP = $80/MWh
- W = 1.1

Using equation 7 above:
MOC ($/MWh) = [{IHR + IMHR}*$FIPR_r$ + VOM]* W

Where,

IMHR = VOMP/ $FIPR_r$ avg

Table 2: Summary

Point	MW	IHR	VOM	VOMP[a]	IMHR[b]	Final IHR	Final VOM	MOC
1	30	8				8	3	38.5
2	40	8.2				8.2	3	39.38
3	50	8.4				8.4	3	40.26
4	60	8.6				8.6	3	41.14
5	70	8.8				8.8	3	42.02
6	80	9	3			9	3	42.9
7	90	9.2				9.2	3	43.78
8	**100**	9.4				9.4	3	44.66
9	**110**	9.6				9.6	3	45.54
10	**120**	9.6		**80**	20	29.6	3	133.54

Power Augmentation operating range

[a] Incremental cost above normal VOM

[b] Excludes VOM for normal operations ($3/MWh)

$FIPR_r$ avg = $4/MMBtu; IMHR = 20($/MWh) / 4($/MME

Note 1: Every month ERCOT calculates a new value of IMHR and combines it with existing IHR. The effective date for the new IMHR value is the first of every month to the end of month.

Note 2: If the Incremental Heat Rate changes over the output range of power augmentation, an appropriate adjustment to the Final IHR will be made.

Appendix 9: Procedure for incorporating Variable O&M (VOM) for power augmentation techniques into the Mitigated Offer Cap (MOC)

Description

Resources using power augmentation techniques such as Peak or Duct Firing, Steam Injection and Air Cooled Condenser Fogging, may be subject to higher operations and maintenance costs, while these technologies are usually not part of the units normal operations. These incremental costs (and possibly changes to the heat rates) cannot be incorporated into the "normal" operating range of the Mitigated Offer Curve (MOC) due to current limitations in the ERCOT systems. As a result, the following procedure offers a manual option to include the VOM into the MOC until a system change is made to allow variations in the variable O&M.

General form of the Mitigated Offer Cap

Resources that are solving non-competitive solutions under Step 2 of SCED are mitigated based on the greater of the reference LMP at the appropriate Resource Node from Step 1 or the MOC. In general, the MOC is calculated as:

The greater of A or B (based on verifiable costs)

A. Generic Heat Rate x Fuel Price

B. [Incremental Heat Rate (IHR) x Fuel Price + VOM]* W

Where,

W = Factor as defined in paragraph (e) of Protocol Section 4.4.9.4.1, Mitigated Offer Cap.

If the Resource has submitted an actual IHR (verifiable cost),

1. $MOC = [IHR_i \times FIP + VOM]^* W$

   Where, i = 1...10

   And FIP = Fuel Price

   And VOM = constant value along the IHR curve

Including units of measurements

2. MOC ($/MWh) = [$IHR_i$ (MMBtu/MWh) x FIP ($/MMBtu) + VOM ($/MWh)]* W

Including a VOM for power Augmentation

3. MOC ($/MWh) = [$IHR_i$ (MMBtu/MWh) x FIP ($/MMBtu) + VOM ($/MWh) + VOMP ($/MWh)]* W

   Where,

   VOM = average variable O&M for operations without power augmentation, and
   VOMP= corresponding variable O&M value for power augmentation technique (assuming only one power augmentation online)

Re-arranging equation 3

4. MOC ($/MWh) = [$IHR_i$ (MMBtu/MWh) + VOM ($/MWh)/ FIP ($/MMBtu) + VOMP ($/MWh)/ FIP ($/MMBtu)] * FIP ($/MMBtu) * W

Or (and omitting the units)

5. MOC = [IHR_i + VOM / FIP + VOMP / FIP] * FIP * W

   Note, the term VOMP / FIP is an implied heat rate (IMHR), or

6. MOC = [IHR_i + VOM / FIP + IMHR] *FIP * W

   And

7. **MOC = [(IHR_i + $IMHR_j$)*FIP + VOM]* W**

   Where,

   $IMHR_j$ = VOMP/ FIPavg, and **$_j$** = 10 (assuming power augmentation is added to the last point of the IHR curve as shown in Table 1 below.

   FIPavg = represents the average Fuel Index Price for the first two weeks of the month prior to the effective month. For example, the FIPavg for August is based on the average FIP price for period July 1- July 15.

Table 1: Summary

Point	MW	IHR	VOM	VOMP[a]	IMHR[b]	Final IHR	Final VOM
1	MW1	IHR1	VOM	Null	Null	IHR1	VOM
2	MW2	IHR2				IHR2	
3	MW3	IHR3				IHR3	
4	MW4	IHR4				IHR4	
5	MW5	IHR5				IHR5	
6	MW6	IHR6				IHR6	
7	MW7	IHR7				IHR7	
8	MW8	IHR8				IHR8	
9	MW9	IHR9				IHR9	
10	MW10	IHR10		VOMP	IMHR	IHR10+IMHR	

Power Augmentation operating range

[a] VOMP - Incremental variable cost above normal VOM

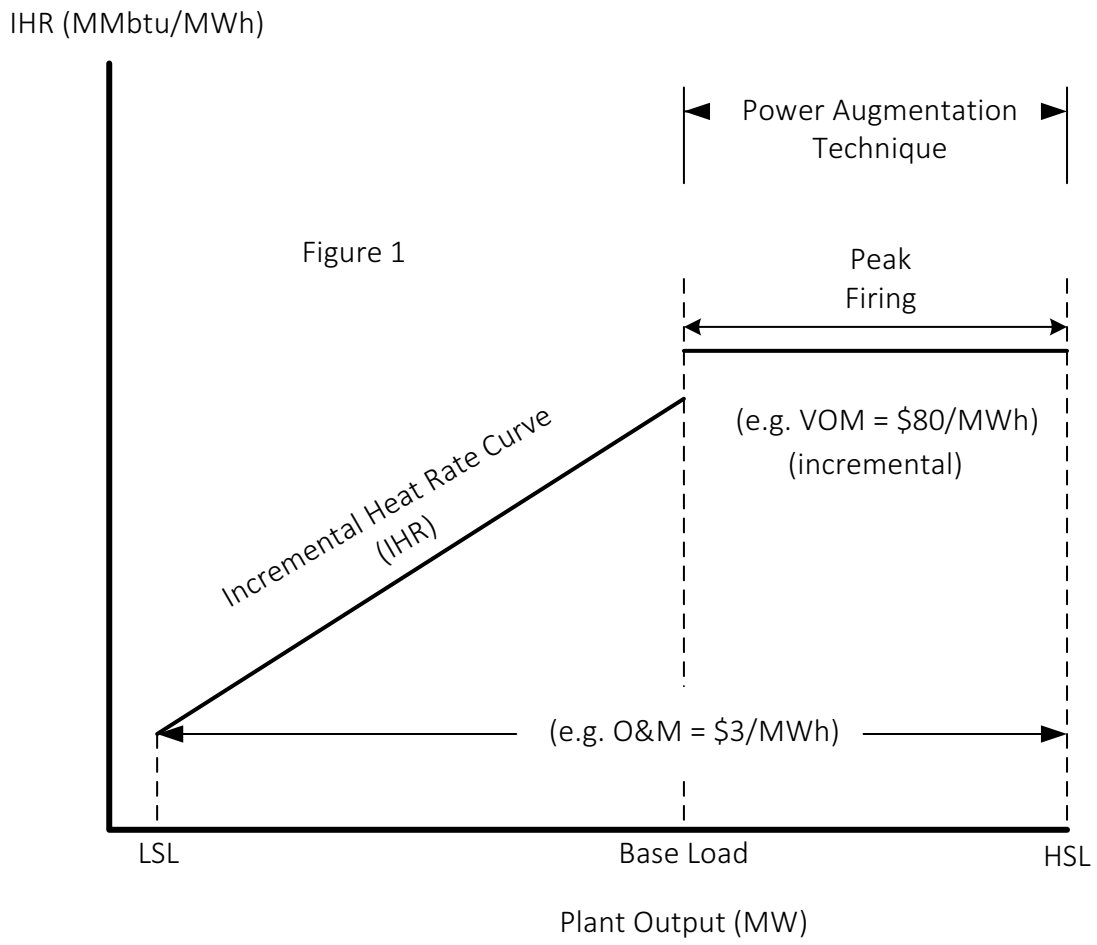
[b] IMHR = VOMP/FIP_{avg}

Section 5 – Interim solution sample calculation

The following example provides an illustration of the manual calculation to incorporate the VOMP of a single power augmentation technique into the MOC.

Typical Power Augmentation Arrangement

Note: Assume the power augmentation block is 10MW and constant IHR equal to the last point on the curve without power augmentation.



Example using Figure 1

- HSL = 120MW (normal)
- FIP = FIPavg = $4/MMBtu
- VOM = $3/MWh
- VOMP = $80/MWh
- W = 1.1

Using equation 7 above:
MOC ($/MWh) = [{IHR + IMHR}*FIP + VOM]* W

Where,

IMHR = VOMP/ FIPavg

Table 2: Summary

Point	MW	IHR	VOM	VOMP[a]	IMHR[b]	Final IHR	Final VOM	MOC
1	30	8	3			8	3	38.5
2	40	8.2				8.2	3	39.38
3	50	8.4				8.4	3	40.26
4	60	8.6				8.6	3	41.14
5	70	8.8				8.8	3	42.02
6	80	9				9	3	42.9
7	90	9.2				9.2	3	43.78
8	**100**	9.4				9.4	3	44.66
9	**110**	9.6				9.6	3	45.54
10	**120**	9.6		**80**	20	29.6	3	133.54

Power Augmentation operating range

[a] Incremental cost above normal VOM

[b] Excludes VOM for normal operations ($3/MWh)

FIP_{avg} = $4/MMBtu; IMHR = 20($/MWh) / 4($/MMBtu)

Note 1: Every month ERCOT calculates a new value of IMHR and combines it with existing IHR. The effective date for the new IMHR value is the first of every month to the end of month.

Note 2: If the Incremental Heat Rate changes over the output range of power augmentation, an appropriate adjustment to the Final IHR will be made.

Appendix 10: Procedure for Evaluating Costs and Caps for Energy Storage Resources

Description

Energy Storage Resources are Resources that are capable of storing energy using Wholesale Storage Load (WSL) and releasing that energy at a later time to generate electric energy. These Resources will need to register under the Resource Category, "Other." Energy Storage Resources that have registered with ERCOT will receive the generic offer caps as described in this appendix, with the exception of standard O&M costs. ERCOT will utilize the costs and caps as described below. ERCOT will calculate these caps on a monthly basis.

Standard O&M Costs

For Energy Storage Resources that choose to submit actual verifiable costs, these Resources may elect to utilize the standard costs for O&M as listed in the table below.

Resource Type	Cold Startup ($/Start)	Intermediate Startup ($/Start)	Hot Startup ($/Start)	Variable O&M ($/MWh)
Natural gas driven Compressed Air Energy Storage Resource	5,000	5,000	5,000	3.15
Non-natural gas driven Compressed Air Energy Storage Resource	5,000	5,000	5,000	3.15
All other Energy Storage Resources	0	0	0	0

Startup Offer Generic Cap for Energy Storage Resources:

Energy Storage Resources that have registered with ERCOT will receive the following O&M Costs:

Energy Storage Resources that have registered with ERCOT will receive the following O&M Costs: **Resource Type**	O&M Costs ($)
Natural gas driven Compressed Air Energy Storage Resource	5,000
Non-natural gas driven Compressed Air Energy Storage Resource	5,000
All other Energy Storage Resources	0

Minimum-Energy Generic Cap for Energy Storage Resources:

The Minimum-Energy Generic Cap for Energy Storage Resources represents a threshold limit. These Resources, however, may submit offers that exceed this limit. For Resources that receive RUC instructions without a Minimum Energy Offer, ERCOT will calculate the Minimum Energy Price per paragraph (3) of Section 5.7.1.4, Revenue Less Cost During QSE Clawback Intervals, of the Nodal Protocols, utilizing the data from the formula shown below.

Minimum-Energy Generic Cap = a1 * (Previous month first 15-day DAM average of corresponding WSL Resource Node Settlement Point Price) + b * FIP + c

Where:

For Natural Gas Driven Compressed Air Energy Storage Resources:

a1 = 1.2

b = 6 MMBtu/MWh

c = $15/MWh

For Non-Natural Gas Driven Compressed Air Energy Storage Resources:

a1 = 1.45

b = 0 MMBtu/MWh

c = $35/MWh

For All Other Energy Storage Resources:

a1 = 1.25

b = 0 MMBtu/MWh

c = $35/MWh

Energy Offer Curve Caps for Make-Whole Calculations for Energy Storage Resources

An Energy Storage Resource's submitted Energy Offer Curve is not capped for make-whole calculation purposes.

Mitigated Offer Cap (MOC) for Energy Storage Resources:

Standard Mitigated Offer Cap for Resources that have submitted VC:

1. MOC = [IHR * FIP+ O&M] * multiplier

Mitigated Offer Cap for Energy Storage Resources:

2. MOC = [a2 * (Previous month first 15-day DAM average of corresponding WSL Resource Node Settlement Point Price) + b * FIP + c] * multiplier

In order to manually implement the Mitigated Offer Cap for Energy Storage Resources, ERCOT will utilize the standard MOC format as follows:

Let O&M = a2 * (Previous month first 15-day DAM average of corresponding WSL Resource Node Settlement Point Price) + c

Let IHR = b

Where:

For Natural Gas Driven Compressed Air Energy Storage Resources:

a2 = 1.5

b = 6 MMBtu/MWh

c = $15/MWh

For Non-Natural Gas Driven Compressed Air Energy Storage Resources:

a2 = 1.75

b = 0 MMBtu/MWh

c = $35/MWh

For All Other Energy Storage Resources:

a2 = 1.75

b = 0 MMBtu/MWh

c = $35/MWh

Sample Calculation for a Natural Gas Driven Compressed Air Energy Storage Resource

- a1 = 1.2
- a2 = 1.5
- b = 6 MMBtu/MWh
- c = $15/MWh
- Fuel Index Price (FIP) = $5/MMBtu

- Previous month first 15-day DAM average of corresponding WSL Resource Node Settlement Point Price = $30/MWh
- Capacity Factor = 35%
- Multiplier = 1.15

Determine Startup Offer Generic Cap:

Startup Offer Generic Cap = $5,000

Determine Minimum Energy Generic Cap:

Minimum-Energy Generic Cap[3] = a1 * (Previous month first 15-day DAM average of corresponding WSL Resource Node Settlement Point Price) + b * FIP + c

Minimum Energy Generic Cap = 1.2 * ($30/MWh) + 6 MMBtu/MWh * $5/MMBtu + $15/MWh

= $36/MWh + $30/MWh + $15/MWh

= $81/ MWh

Determine Mitigated Offer Cap:

MOC = [IHR * FIP+ O&M] * multiplier

IHR= 6MMBtu/MWh

O&M = a2 * (Previous month first 15-day DAM average of corresponding WSL Resource Node Settlement Point Price) +c

= 1.5 * $30/MWh + $15/MWh

= $45/MWh + $15/MWh

= $60/MWh

MOC = [6MMBtu/MWh * $5/MMBtu+ $60/MWh] * 1.15

= [$30/MWh + $60/MWh] * 1.15

= $90/MWh * 1.15

[3] The Minimum Energy Generic Cap is only used when Energy Storage Resources receive RUC instructions without a Minimum Energy Offer.

= $103.50/MWh

Appendix 11: Standard Affidavits

The following pages contain the standard affidavits required when the Resource Entity and the QSE have agreed that the Resource Entity will submit verifiable cost data to ERCOT. Both affidavits must be executed and sent to ERCOT.

STATE OF TEXAS §
§
COUNTY OF _____ §

VERIFIABLE COSTS AFFIDAVIT PURSUANT TO SECTION 5.6.1 FOR RESOURCE ENTITY

BEFORE ME, the undersigned notary, on this day personally appeared the following individual: _____, whose identity is known to me. After being first duly sworn, the named individual deposed and stated the following:

1. "My name is _____. I am the Authorized Representative of the Resource Entity (RE) identified in Paragraph 2. I am over 18 years of age, of sound mind, and capable of making this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct.
2. I am employed as _____, by _____, having its principal place of business at _____. This company is registered as an RE with ERCOT.
3. I agree to the terms as described below and that such terms satisfy the requirement in Section 5.6.1, *Verifiable Costs*, of the ERCOT Protocols for an RE to assume the responsibility of providing verifiable costs to ERCOT.
4. _____ is the Qualified Scheduling Entity (QSE) agreeing that RE will assume the responsibility of providing verifiable costs to ERCOT. QSE has executed a similar affidavit in order to comply with Section 5.6.1 of the ERCOT Protocols and effectuate this transfer of responsibility.

5. This Affidavit pertains to the following Resource(s) (Resource Mnemonic(s)): _____. If naming multiple resources attach as separate document. Named resources must match list provided in QSE Affidavit.

6. RE acknowledges the following:

   a. All RUC Instructions from ERCOT will be sent to QSE.

   b. All financial arrangements are between ERCOT and QSE.

   c. Verifiable costs are Resource-specific costs, regardless of who submits them. QSE costs shall not be accepted by ERCOT even when verifiable costs are submitted by RE.

   d. RE will have sole responsibility for submitting verifiable costs to ERCOT and such arrangement will remain in place until RE switches to another QSE or terminates its registration with ERCOT. If RE switches to another QSE, the new QSE assumes responsibility for submitting or updating verifiable costs unless new affidavits are submitted to ERCOT allowing RE to continue to submit or update existing verifiable costs in accordance with Section 5.6.1 of the ERCOT Protocols.

   e. QSE will have responsibility for informing RE to update or file verifiable costs with ERCOT.

   f. During the verifiable cost approval process, only RE will have the authority to appeal specific cost categories with ERCOT, ERCOT Board of Directors, or the Public Utility Commission of Texas (PUCT).

   g. RE will have sole responsibility for the accuracy of the data submitted to ERCOT. QSE is not responsible for the accuracy of the data submitted to ERCOT by RE.

7. ERCOT will not share Resource-specific costs (except for final approved costs) with QSE without further written permission by RE."

_____
Affiant for RE

SUBSCRIBED AND SWORN TO BEFORE ME on this _____ day of _____, 20___.

_____
Notary Public, State of Texas

STATE OF TEXAS §
§
COUNTY OF _____ §

VERIFIABLE COSTS AFFIDAVIT PURSUANT TO SECTION 5.6.1 FOR QUALIFIED SCHEDULING ENTITY

BEFORE ME, the undersigned notary, on this day personally appeared the following individual: _____, whose identity is known to me. After being first duly sworn, the named individual deposed and stated the following:

1. "My name is _____. I am the Authorized Representative of the Qualified Scheduling Entity (QSE) identified in Paragraph 2. I am over 18 years of age, of sound mind, and capable of making this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct.
2. I am employed as _____, by _____, having its principal place of business at _____. This company is registered as a QSE with ERCOT.
3. I agree to the terms as described below and that such terms satisfy the requirement in Section 5.6.1, *Verifiable Costs*, of the ERCOT Protocols for a Resource Entity (RE) to assume the responsibility of providing verifiable costs to ERCOT.
4. _____ is the RE agreeing that it will assume the responsibility of providing verifiable costs to ERCOT. RE has executed a similar affidavit in order to comply with Section 5.6.1 of the ERCOT Protocols and effectuate this transfer of responsibility.
5. This Affidavit pertains to the following Resource(s) (Resource Mnemonic(s)): _____. If naming multiple resources attach as separate document. Named resources must match list provided in RE Affidavit.
6. QSE acknowledges the following:
    h. All RUC Instructions from ERCOT will be sent to QSE.
    i. All financial arrangements are between ERCOT and QSE.
    j. Verifiable costs are Resource-specific costs, regardless of who submits them. QSE costs shall not be accepted by ERCOT even when verifiable costs are submitted by RE.

k. RE will have sole responsibility for submitting verifiable costs to ERCOT and such arrangement will remain in place until RE switches to another QSE or terminates its registration with ERCOT. If RE switches to another QSE, the new QSE assumes responsibility for submitting or updating verifiable costs unless new affidavits are submitted to ERCOT allowing RE to continue to submit or update existing verifiable costs in accordance with Section 5.6.1 of the ERCOT Protocols.

l. QSE will have responsibility for informing RE to update or file verifiable costs with ERCOT.

m. During the verifiable cost approval process, only RE will have the authority to appeal specific cost categories with ERCOT, ERCOT Board of Directors, or the Public Utility Commission of Texas (PUCT).

n. RE will have sole responsibility for the accuracy of the data submitted to ERCOT. QSE is not responsible for the accuracy of the data submitted to ERCOT by RE.

7. ERCOT will not share Resource-specific costs (except for final approved costs) with QSE without further written permission by RE."

_____
Affiant for QSE

SUBSCRIBED AND SWORN TO BEFORE ME on this _____ day of _____, 20___.

_____
Notary Public, State of Texas

Election to use the Expected Minimum On-Line Time for Quick Start Generation Resource

Pursuant to ERCOT Protocol Section 4.4.9.4.1, Mitigated Offer Cap, ERCOT will apply a minimum On-Line time value in determining the incremental costs for the variable O&M component of calculated mitigated offer cap for a Quick Start Generation Resource (QSGR). The expected minimum On-Line time applied in determining the variable O&M term is equal to the registered minimum On-Line time value, unless the Resource Entity (RE) or QSE, representing the QSGR, has notified ERCOT that the expected minimum On-Line time should be different than the registered value. By submitting this form, the RE or QSE acknowledges that the expected minimum On-Line time is different from the registered value. The Authorized Representative of the RE or QSE must sign this form. An electronic copy of the signed form may be attached in PDF format to a Service Request. The Service Request is available on the ERCOT Market Information System (MIS) (Applications, Service Request). The Service Request must be submitted using the Authorized Representative's digital certificate. Complete all required fields then choose Request Type "MP Registration" and Request Sub-Type "Resource/Asset Registration". An alternative to the Service Request may be used by sending the signed form to ERCOT by email to mpappl@ercot.com or via facsimile: (512) 225-7079.

Please note that the election to use the expected minimum On-Line time for a specific Resource is *irrevocable for the season(s) specified in the form.* For seasonal changes to be effective, ERCOT must receive the completed election form at least fifteen (15) days prior to the start of the elected season. [Season is defined by Protocol, Section 2 as follows: Winter months are December, January and February; Spring months are March, April and May; Summer months are June, July and August; Fall months are September, October and November.]

Requestor: RE: ☐ or QSE representing QSGR: ☐
Duns Number:
Name of Generator Site:
County:
Identify all Resource(s) which will use expected minimum On-Line time:

Unit Name	Resource ID	Expected Minimum On-Line Time (hr)(1)	Season

Note: Resources requesting Expected Minimum On-Line Times less than 1 hour must have approved verifiable costs before the expected value is approved.
Request date:

By signing below I affirm that all statements made and information provided in this form are true, correct and complete. I understand that the elections for the specific Resource(s) made in this form are irrevocable for the remainder of the season in which they are made.

For Resource Entity:

Printed name of Authorized Representative:	
Signature of Authorized Representative:	
Title:	