Manual 15, Cost Development Guidelines

Ilyana Dropkin, Sr. Engineer II
Performance Compliance

Cost Development Subcommittee
July 1, 2025

Revision 47 (10/01/2025):

All changes are conforming to Regulation Redesign Phase I

- Section 2.8:
  - Rename Regulation Performance to Regulation Mileage
  - Cost increase in VOM is for Regulation Only Resources
  - Corrected units from MMBtu/kWh to Btu/kWh, from 12, 5000 to 12, 500 for Heat Rate @ RegMin and update VOM from $3.50 to $0 in an example for a sub-critical coal-fired steam unit providing Regulation Service for the last seven years.
  - Rename Historic Mileage from Reg. Historic Mileage (RegA) to Reg.Mileage
  - Update Regulation VOM Adder from $3.50 to $0
  - Updated calculated value for Exhibit 3: Regulation Maximum Allowable Cost Adder Example

- Section 2.8:
  - Rename Regulation Performance to Regulation Mileage
  - Cost increase in VOM is for Regulation Only Resources

The cost-based regulation offer is split into two portions:

- The Regulation Capability portion consists of the fuel cost increase and unit specific heat rate degradation due to operating at lower loads and the margin risk adder;
- The Regulation Mileage~~Performance~~ portion consists of the cost increase in VOM for Regulation Only Resources, cost increase due to heat rate increase during non-steady state operation and, where applicable, energy losses for energy storage devices. The $/MW value determined in the mileage~~performance~~ offer will be converted to cost per mileage $/ΔMW by dividing the value by the mileage ΔMW/MW for the applicable signal for that offer as described in Manual 11.
- Regulation Capability costs to provide Regulation Service from a unit shall include the following components up to but not exceeding:

$$RegulationCapabilityCosts(\$ / MWh) \leq$$

$$(Fuel\ Cost\ Increase\ and\ UnitSpecific\ Heat\ Rate\ Degradation\ due\ to\ Operating\ at\ Lower\ Loads)$$

$$+MarginRisk\ Adder$$

- Regulation Mileage~~Performance~~ costs to provide Regulation Service from a unit shall include the following components up to but not exceeding:

$$Regulation\ Mileage\ Costs\left(\frac{\$}{\Delta MW}\right) \leq$$

$$\{Cost\ Increase\ in\ VOM\ \ For\ \ Regulation\ \ Only\ \ Resources + Cost\ Increase\ due\ to\ Heat\ Rate\ Increase\ during\ nonsteady\ state\ operation$$

$$(above\ heat\ rate\ factor\ not\ to\ exceed\ 0.35\%) + (Energy\ Storage\ Unit\ Losses)\} / \Delta MW / MW$$

- Section 2.8:
  - Cost increase in VOM is for Regulation Only Resources

Cost increase in VOM for Regulation Only Resources

The cost increase (in $/MWh of Regulation) of variable operations and maintenance (VOM) cost resulting from operating the unit at lower MW output incurred from the provision of Regulation. This cost component is zero for units participating in the energy market as these VOM costs are already recoverable in a unit's cost based energy offer. ~~VOM costs shall be calculated by the following methods and shall not exceed those levels below:~~

~~For any unit that does not have a PJM approved Maintenance Adder, the following variable operation and maintenance (VOM) costs can be applied by unit type to the following:~~

~~Unit Type~~	~~VOM~~
~~Super-critical Steam:~~	~~$10.00 per MWh of Regulation~~
~~Sub-critical Steam:~~	~~$3.50 per MWh of Regulation~~
~~Combined Cycle:~~	~~$2.50 per MWh of Regulation~~
~~Combustion Turbine:~~	~~$2.00 per MWh of Regulation~~
~~Hydro:~~	~~$1.00 per MWh of Regulation~~
~~Energy Storage:~~	~~Based on OEM estimates initially and actual as history is available~~

~~*Exhibit 1: VOM for all Hydro Units or Non-Hydro Units providing service for less than 10 years*~~

- Section 2.8:
  - Cost increase in VOM is for Regulation Only Resources

~~Any unit that has a PJM approved Maintenance Adder can use the VOM rates above if the annual VOM dollar amounts resulting from those rates included in Regulation cost based offers, are subtracted from the escalated 10 or 20 year historical total VOM accounts and the Regulation MWh based on the average of the last three years.~~

Energy storage units that participate only in regulation Service may~~shall~~ include all their VOM Cost increase in VOM adder in Regulation cost offers~~.~~ based on actual maintenance cost history. These maintenance costs must be submitted and approved by PJM in the annual VOM review process as outlined in Manual 15 Section 2.6 prior to use in the offer.

~~For example, a 100 MW sub-critical coal fired steam unit that has been providing Regulation Service for 30 years. The unit averaged 5,000 MWh of Regulation Service over the last three years and the escalated 20 year historical total VOM = $10,000,000.~~

~~Annual VOM Costs to Subtract~~
~~= ($3.50 per Regulation MWh * 5,000 MWh) * 20 years~~
~~= $17,500 per year * 20 years~~
~~= $350,000~~
~~20 year balance of historical total VOM accounts~~
~~= $10,000,000 - $350,000~~
~~= $ 9,650,000~~

~~*Exhibit 2: Example of VOM for Non-Hydro Units providing Regulation for more than 10 years*~~

Actual ~~Regulation VOM incremental costs submitted and evaluated pursuant to the Cost Methodology and Approval Process.~~

- Section 2.8:
  - Corrected units from MMBtu/kWh to Btu/kWh, from 12, 5000 to 12, 500 for Heat Rate @ RegMin and updated VOM from $3.50 to $0 in an example for a sub-critical coal-fired steam unit providing Regulation Service for the last seven years.

~~For~~ An ~~E~~example for a Sub-critical Coal-Fired Steam Unit providing Regulation Service for the last seven years:

Data Submitted by Participant	Value	Units
Fuel	$1.50	$/MMBtu
Heat Rate @ EcoMax	9,000.00	~~MM~~Btu/KWh
Heat Rate @ RegMin	12,500~~0~~.00	~~MM~~Btu/KWh
VOM	$0~~3.50~~	$/MW of Regulation

- Section 2.8:
  - Corrected units from MMBtu/kWh to Btu/kWh, from 12, 5000 to 12, 500 for Heat Rate @ RegMin and updated VOM from $3.50 to $0 in an example for a sub-critical coal-fired steam unit providing Regulation Service for the last seven years.

$$UnitBaseLoadHeatRateFuelInput =$$

$$UnitBaseLoadHeatRate * RegMin * 1MMBtu / 1{,}000{,}000Btu * 1{,}000\ kW / MW$$

$$UnitBaseLoadHeatRateFuelInput =$$

$$9{,}000\ Btu / kWh * 40\ MW * 1MMBtu / 1{,}000{,}000Btu * 1{,}000\ kW / MW = 360\ MMBtu / Hr$$

$$UnitReducedLoadHeatRateFuelInput =$$

$$UnitReducedLoadHeatRate * RegMin * 1MMBtu / 1{,}000{,}000Btu * 1{,}000\ kW / MW$$

$$UnitReducedLoadHeatRateFuelInput =$$

$$12{,}500Btu / kWh * 40\ MW * 1MMBtu / 1{,}000{,}000Btu * 1{,}000kW / MW = 500\ MMBtu / Hr$$

$$Difference = UnitBaseLoadHeatInput - UnitReducedLoadHeatInput$$

$$Difference = 500MMBtu / Hr - 360MMBtu / Hr = 140MMBtu / Hr$$

- Section 2.8:
  - Corrected units from MMBtu/kWh to Btu/kWh, from 12, 5000 to 12, 500 for Heat Rate @ RegMin and updated VOM from $3.50 to $0 in an example for a sub-critical coal-fired steam unit providing Regulation Service for the last seven years.

Heat Rate Adjustment (Non-Steady State Operation)	Value	Units
Total Operating Point Heat Rate	9,000.0	~~MM~~Btu/kWh
Heat Rate Loss Factor (Max per M15)	0.35%	
Heat Rate Loss	3.15	MMBtu/Hr

$$HeatRateLoss = (EconomicMaximumHeatRate * 0.35\%) * 1 MMBtu / 1{,}000{,}000 Btu * 1{,}000 kW / MW * EconomicMaximumMW$$

$$Heat\ Rate\ Loss = (9{,}000 Btu / kWh * 0.35\%) * 1 MMBtu / 1{,}000{,}000 Btu * 1{,}000 kW / MW * 100 MW = 3.15\ MMBtu / Hr$$

- Section 2.8:
  - Rename Historic Mileage from Reg. Historic Mileage (RegA) to Reg.Mileage

Historic Mileage	Value
Reg. Mileage~~A~~	5

Maximum Mileage ~~Performance~~ Offer	Value	Units
(c+d)/Reg.~~Historic~~ Mileage	$0.1~~8~~0	$/ΔMW

MaximumPerformanceOffer =

[*FuelCostAdder* (*NonSteadyStateOperation*) + *RegulationVOMAdder for Regulation Only Resources*] / *Reg. Mileage*

- Section 2.8:
  - Update Regulation VOM Adder from $3.50 to $0

(d) VOM Adder	Value	Units
Regulation VOM Adder	$0~~3.50~~	$/Hr/MW of Regulation

- Section 2.8:
  - Updated calculated value for Exhibit 3: Regulation Maximum Allowable Cost Adder Example

MaximumPerformanceOffer =

[*FuelCostAdder* (*NonSteadyStateOperation*) + *RegulationVOMAdder for Regulation Only Resources*] / *Reg. Mileage*

Regulation Maximum Allowable Cost Adder Example:

FuelCostAdder =
[$0.50 / *Hr* / *MW* + $0 / *Hr* / *MW*] / 5 Δ *MW* / *MW* = $0.10 / *Hr* / *MWofRegulation*

Exhibit 3: Regulation Maximum Allowable Cost Adder Example

Contact

SME/Presenter:
Ilyana Dropkin,

ilyana.dropkin@pjm.com

Manual 15, Rev 47 – Regulation Redesign Phase I

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com