2.6.5 Immature Units: Maintenance Costs

Immature Units - are units with neither ~~less than~~ 10 years of operation ~~history~~ nor 3~~5~~0,000 ~~Equivalent~~Operating ~~Service~~ Hours.

Immature Units should use a blend of actual~~, costs, and~~ calculated or forecasted costs. The weighted blend should be based on the ratio of historical operating hours to projected hours to meet 3~~5~~0,000 or achieving ten years of operation whichever comes first. All historical, calculated, and/or forecasted costs are to be converted to current year dollars.

When information is not available to the Market Participant, estimates may be developed based on a methodology consistent with the provisions of Manual 15 related to VOM, such as, but not limited to:

- Regional industry average

- Industry average in PJM

- ~~Budgeted~~Forecasted value ~~for the business case~~based on Long Term Business Plan

- Information from OEM

- or information from sister units

Once a unit ~~hits~~reaches either 10 years of operation or 50,000 Operating Hours, it is considered a mature unit. Once a unit is mature, it will use actual historical maintenance cost and the owner will decide to use a 10 or 20 year history (see section 2.6.2). If a mature unit has less maintenance history than its elected historical period, the unit owner will use all available history to calculate VOM.

Example 2: Immature Unit

- A Combustion Turbine with 5,000 ~~equivalent service~~operating hours after 10 years of operation with an unknown maintenance history

In this example the unit owner does not have the necessary information to compute historical maintenance costs. This unit could use:

a. Regional industry average
b. Industry average in PJM
c. Budgeted value for the business case
d. Information from OEM
e. Information from sister units

The unit owner decides to use the budgeted value from the business model of $25/ESH initially and a ten year maintenance history. In the following years the unit's VOM would be calculate as follows:[i]

Year	Cumulative ~~ES~~OH	VOM Calculation
1	6000	(Year 1 Total Actual Maintenance $ + (9 * 1000*$25/~~ES~~OH)) / 10,000 ~~ES~~OH
2	7000	(Year 1+2 Total Actual Maintenance + (8 *1,000 $25/~~ES~~OH)) / 10,000

		~~ES~~OH
3	8000	(Year 1+2+3 Total Actual Maintenance + (7 *1000* $25/~~ES~~OH)) / 10,000 ~~ES~~OH
4	9000	(Year 1+2+3+4 Total Actual Maintenance + (6 *1000* $25/~~ES~~OH)) / 10,000 ~~ES~~OH
5	10000	(Year 1+2+3+4+5 Total Actual Maintenance + (5 *1000* $25/~~ES~~OH)) / 10,000 ~~ES~~OH
6	11000	(Year 1+2+3+4+5+6 Total Actual Maintenance + (4 * 1000*$25/~~ES~~OH)) / 10,000 ~~ES~~OH
7	12000	(Year 1+2+3+4+5+6+7 Total Actual Maintenance + (3 * 1000*$25/~~ES~~OH)) / 10,000 ~~ES~~OH
8	13000	(Year 1+2+3+4+5+6+7+8 Total Actual Maintenance + (2 * 1000*$25/~~ES~~OH)) / 10,000 ~~ES~~OH
9	14000	(Year 1+2+3+4+5+6+7+8+9 Total Actual Maintenance + (1 * 1000*$25/~~ES~~OH)) / 10,000 ~~ES~~OH
10	15000	(Year 1+2+3+4+5+6+7+8+9+10 Total Actual Maintenance) / 10,000 OH Unit is now Mature

4.6 Maintenance Cost

> **Note:** The information in Section 2.6 contains basic Maintenance Cost information relevant for all unit types. The following information only pertains to fossil steam units.

Fossil Steam - Maintenance Adder - is the dollars per unit of fuel (or heat) as derived from FERC Accounts 512 and 513 for fossil steam units.

> **Notes:** Total Maintenance Dollars (TMD) plus (+) Total Start Maintenance Dollars (TSD) cannot exceed Total Dollars in FERC Accounts 512 and 513.
>
> ~~Units with less than 7 years of history are considered immature. Such units can be assigned their calculated Maintenance Adder and/or Start Cost Maintenance Adder, or a forecast values, subject to evaluation pursuant to the Cost and Methodology Approval Process.~~

Calculate total Maintenance Dollars for 2011, this example assumes a maintenance period of 10 years; please see section 2.6.3 for further explanation of Maintenance Periods.

$$\text{Total Configuration Addition Maintenance Dollars} =$$

$$\left(\text{Incremental (FERC 512 + 513} - \text{Start Cost FERC 512 + 513)}_{2010} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2010}}\right) +$$

$$\left(\text{Incremental (FERC 512 + 513} - \text{Start Cost FERC 512 + 513)}_{2009} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2009}}\right) +$$

$$\left(\text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2008} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2008}} \right) + \cdots$$

$$\left(\text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2000} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2000}} \right)$$

Calculate total fuel burned (heat input in MBtu) for the maintenance period.

$$\text{Total Fuel} = \text{Fuel}_{2010} + \text{Fuel}_{2009} + \text{Fuel}_{2008} + 00\text{Fuel}_{2000}$$

These allow for the calculation of the maintenance adder:

$$\text{Maintenance Adder}_{2011} (\$/\text{MBTU}) = \frac{\text{Total Maintenance Dollars}}{\text{Total Fuel}}$$

Exhibit 9: Fossil Steam Unit's Sample Formula of Maintenance Adder

To Calculate the Start Maintenance Adder, Calculate the total Start Maintenance Cost. Please note the expenses in the maintenance adder and the expenses in the start maintenance adder are mutually exclusive.

$$\text{Total Start Maintenance Cost} =$$

$$\left(\text{(Start Cost FERC 512 + 513)}_{2010} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2010}} \right) +$$

$$\left(\text{(Start Cost FERC 512 + 513)}_{2009} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2009}} \right) +$$

$$\left(\text{(Start Cost FERC 512 + 513)}_{2008} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2008}} \right) + \cdots$$

$$\left(\text{(Start Cost FERC 512 + 513)}_{2000} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2000}} \right)$$

This formula calculates the total number of starts:

$$\text{Total Starts} = \text{Starts}_{2010} + \text{Starts}_{2009} + \text{Starts}_{2008} + \cdots + \text{Starts}_{2000}$$

These allow for the calculation of the start maintenance adder:

$$\text{Start Maintenance Adder (\$/Start)} = \frac{\text{Total Start Maintenance Cost}}{\text{Total Starts}}$$

Exhibit 10: Fossil Steam Unit's Sample Formula of Start Maintenance Adder

5.6.3 Equivalent service hours (ESH)

The estimated hours the unit will run based on history:

$$\text{Equivalent Service Hours} =$$

$$(\text{Cyclic Starting Factor} * \text{Number of Starts}) + \text{Total Operating Hours at any load level}$$

$$+ (\text{Cyclic Peaking Factor} * \text{Number of Hours above Base load temperature limit})$$

Where:

Cyclic starting factor = 5.0 for aircraft - type CTs and 10.0 for industrial - type CTs

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.

Cyclic peaking factor = 3.0 for all CTs

This means that the additional incremental maintenance charged to the incremental energy between base and peak loads is equivalent to the incremental maintenance attributable to three hours of base load operation.

> **Note:** Units with less than seven years of history are considered immature. Such units can be assigned either their calculated Equivalent Hourly Maintenance Cost, or a forecast value, subject to evaluation pursuant to the Cost and Methodology Approval Process.
>
> If any unit in a block is at least seven years old, then all like units on the block may be considered mature.

6.6.3 Equivalent service hours (ESH)

The estimated hours the unit will run based on history.

$$\text{Equivalent Service Hours} =$$

$$(\text{Cyclic Starting Factor} * \text{Number of Starts}) + \text{Total Operating Hours at any load level}$$

$$+ (\text{Cyclic Peaking Factor} * \text{Number of Hours above Base load temperature limit})$$

Where:

Cyclic starting factor = 5.0 for aircraft - type CTs and cyclic starting factor= 10.0 for industrial - type CTs

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.

 Cyclic peaking factor = 3.0 for all CTs

This means that the additional incremental maintenance charged to the incremental energy between base and peak loads is equivalent to the incremental maintenance attributable to three hours of base load operation.

Note: Units with less than seven years of history are considered immature. Such units can be assigned either their calculated Equivalent Hourly Maintenance Cost, or a forecast value, subject to evaluation pursuant to the Cost and Methodology Approval Process.

If any unit in a block is at least seven years old, then all like units on the block may be considered mature.

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[i] We are ignoring the effects of inflation and use of the Handy Whitman Index for simplicity.