



PJM Manual 15:

# Cost Development Guidelines

Revision:

Effective Date:

Prepared by

Cost Development Subcommittee

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## Section 2: Policies for All Unit Types

### 2.3 Fuel Cost Guidelines

Any Unit Owner must submit a fuel cost policy to the PJM MMU pursuant to the Cost and Methodology Approval Process.

#### 2.3.1 Modifications to Fuel Cost Policies

A request to change the method of calculation of Basic Fossil or Nuclear Fuel Cost shall be submitted to the PJM MMU for evaluation pursuant to the Cost and Methodology Approval Process in advance of the proposed change (this is referred to below as “the proposal”).

Any Unit Owner and the PJM MMU shall discuss the proposal and the PJM Member will provide documentation supporting its request to the PJM MMU. The PJM MMU shall provide an initial response to the PJM Member in writing within 30 days of the member’s submission of the request to the PJM MMU, indicating its agreement with the request or areas of concern pursuant to the Cost and Methodology Approval Process. The changed method of calculation may be implemented immediately upon final approval pursuant to the Cost and Methodology Approval Process.

If any action by a governmental or regulatory agency external to a Unit Owner that results in a need for the Unit Owner to change its method of fuel cost calculation, the affected PJM Member may immediately submit a request to the PJM MMU for evaluation, pursuant to the Cost and Methodology Approval Process to change the method of calculation in advance of the proposed change.

#### 2.3.2 Fuel Cost Calculation

The method of calculation of fuel cost may be updated no more frequently than once every 12 months, on a rolling basis.

Each company must review and document their fuel costs at minimum once per month (12 times per year). Additionally, each review must occur within forty (40) days of the preceding review. The results of this review will be used to determine whether a fuel cost update is necessary. The documentation of fuel costs must be filed via CODA.

The method of calculation of fuel cost may include the use of actual fuel prices paid, e.g. the contract price paid for fuel, or the spot price for fuel. The contract price for fuel must include the locational cost of fuel for the generating unit. The source used for spot price for fuel must be publicly available and reflect the locational cost of fuel for the generating unit. The locational cost of fuel shall include specification of any additional incremental costs of delivery for the generating unit.

Each PJM Member Company will be responsible for establishing its own method of calculating delivered fossil fuel cost, limited to inventoried cost, replacement cost or a combination thereof, that reflect the way fuel is purchased or scheduled for purchase.

The method of calculation only may be changed by receipt of final approval pursuant to the Cost and Methodology Approval Process in advance of the proposed change.



Fossil fuel cost adjustments compensating for previous estimate inaccuracies should not be considered when determining the basic fossil cost component of Total Fuel Related Cost. Units that co-fire more than one fuel shall weight average the cost of the fuel on a per mmBtu basis. Units that fire solid waste, bio-mass, or landfill gas shall include the cost of such fuel when calculating the average even when the cost of such fuel is negative. However, cost offers for units that fire solid waste, biomass, or landfill gas shall not be less than zero.

## Section 4: Fossil Steam Unit Cost Development

This section contains information pertaining to Fossil Steam Unit Cost development.

**Fossil Steam Turbine plants** use combusted fossil fuels to heat water and create steam that generates the dynamic pressure to turn the blades of a steam turbine generator. Units that fire solid waste, biomass, or landfill gas solely or in conjunction with fossil fuels to heat water and create steam to drive a steam turbine generator are considered to be **Fossil Steam Turbine plants**.

### 4.1 Heat Rate

**Note:** The information in Section 2.1 contains basic Heat Rate information relevant for all unit types including fossil steam units.

### 4.2 Performance Factor

**Note:** The information in Section 2.2 contains basic Performance Factor information relevant for all unit types. The following information only pertains to fossil steam units.

Like units that can be used for calculation of performance factors are units having similar ratings, steam conditions, make or model and same site location.

### 4.3 Fuel Cost

**Note:** The information in Section 2.3 contains basic Fuel information relevant for all unit types. The following information only pertains to fossil steam units.

Fossil fuel cost adjustments compensating for previous estimate inaccuracies should not be considered when determining the basic fossil cost component of Total Fuel Related Cost.

**Fossil Other Fuel-Related Costs.** The dollars in FERC [Account 501 Fuel](#) plus incremental expenses for fuel treatment and pollution control (excluding SO<sub>2</sub> and NO<sub>x</sub> emission allowance costs) that were not included in Account 501; minus the fuel expenses from FERC Account 151 that were charged into Account 501, all divided by the fuel (heat content or quantity) shifted from Account 151 into Account 501.

#### 4.3.1 Total Fuel Related Cost

Total Fuel Related Cost is the sum of the Basic Fuel Cost, applicable Other Fuel-Related Costs and the Maintenance Adder, CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>x</sub> emission allowance costs.

$$\text{Total Fuel Related Cost (\$/MBTU)} =$$

$$\text{Fuel Cost} + \text{Other Fuel Related Cost} + \text{SO}_2 \text{ Allowance Cost} + \text{CO}_2 \text{ Allowance Cost} \\ + \text{NO}_x \text{ Allowance Cost} + \text{Maintenance Adder}$$

$$\text{TFRC} = \text{Total Fuel Related Cost}$$

## 4.4 Hot Start Cost, Intermediate Start Cost, and Cold Start cost

**Note:** The information in Section 2.4 contains basic Start Cost information relevant for all unit types. The following information only pertains to fossil steam units.

$$\begin{aligned} \text{Start Cost (\$/Start)} = & \\ & [\text{Start Fuel Consumed (MBTU / Start)} * \text{TFRC}(\$/\text{MBTU}) * \text{Performance Factor}] + \\ & [\text{Station Service (MWh)} * \text{Station Service Rate}(\$/\text{MWh})] + \text{Start Maintenance Adder} (\$/\text{Start}) + \\ & \text{Start Additional Labor Cost} (\$/\text{Start}) \end{aligned}$$

### 4.4.1 Hot Start Cost

Hot start cost is the expected cost to start a steam unit, which is in the "hot" condition. Hot conditions vary unit by unit, but in general, a unit is hot after an overnight shutdown. Components of hot start cost include:

**Total fuel-related cost** are the costs from first fire of start process to breaker closing (including auxiliary boiler fuel) priced at the cost of fuel currently in effect including shutdown fuel cost defined as the cost of fuel expended from breaker opening of the previous shutdown to initialization of the (hot) unit start-up, excluding normal plant heating/auxiliary equipment fuel requirements.

**Station Service** from initiation of start sequence to breaker closing (total station use minus normal base station use) priced at the Station Service rate and station service after breaker opening during shutdown (station service during shutdown should be that associated with the normal unit auxiliary equipment operated during shutdown in excess of base unit use, this station service is not to include maintenance use or non-normal use) priced at the Station Service rate.

**Additional labor costs** in excess of normal station manning requirements that are incurred when starting the unit.

**Start Maintenance Adder** Section 2.6 contains information regarding calculation of Maintenance Adder.

### 4.4.2 Intermediate Start Cost

Intermediate start cost is the expected cost to start a steam unit during a period where neither hot nor cold conditions apply. Use of intermediate start cost is optional based on company policy and physical machine characteristics. The only restriction is that once an intermediate start cost is defined for a unit, the cost must be used consistently in scheduling and accounting. Components of intermediate start cost include:

**Total fuel-related cost** is the cost from first fire to breaker closing (including auxiliary boiler fuel) priced at the cost of fuel currently in effect, and shutdown fuel cost defined as the cost of fuel expended from breaker opening of the previous shutdown to initialization of the (intermediate) unit start-up, excluding normal plant heating/auxiliary equipment fuel requirements.

**Station Service** from initiation of start sequence to breaker closing (total station use minus normal base station use) priced at the Station Service rate and station service after breaker opening during shutdown (station service during shutdown should be that associated with the normal unit auxiliary equipment operated during shutdown in excess of base unit use, this station service is not to include maintenance use or non-normal use) priced at the Station Service rate.

**Additional labor costs** in excess of normal station manning requirements that are incurred when starting the unit.

**Start Maintenance Adder** Section 2.6 contains information for calculation of the Maintenance Adder.

#### 4.4.3 Cold Start Cost

Cold start cost is the expected cost to start a steam unit that is in the "cold" condition. Cold conditions vary unit by unit, but in general, a unit is cold after a two or three-day shutdown. Components of cold start cost include:

**Total fuel-related cost** from first fire to breaker closing (including auxiliary boiler fuel) priced at the cost of fuel currently in effect, and shutdown fuel cost defined as the cost of fuel expended from breaker opening of the previous shutdown to shutdown of equipment needed for normal cool down of plant components, excluding normal plant heating/auxiliary equipment fuel requirements.

**Station Service** from initiation of start sequence to breaker closing (total station use minus normal base station use) priced at the Station Service rate and station service after breaker opening during shutdown (station service during shutdown should be that associated with the normal unit auxiliary equipment operated during shutdown in excess of base unit use, this station service is not to include maintenance use or non-normal uses) priced at the Station Service rate.

**Additional labor costs** in excess of normal station manning requirements that are incurred when starting the unit.

**Start Maintenance Adder** Section 2.6 contains information for calculation of the Maintenance Adder.

#### 4.5 No Load Cost

**Note:** The information in Section 2.5 contains basic No Load Cost information relevant for all unit types including fossil steam units.

#### 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.

Total Configuration Addition Maintenance Dollars =

$$\begin{aligned} & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2010} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2010}} \right) + \\ & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2009} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2009}} \right) + \\ & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2008} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2008}} \right) + \dots \\ & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2000} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2000}} \right) \end{aligned}$$

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

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

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.

Total Start Maintenance Cost =

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

$$\begin{aligned} & \left( (\text{Start Cost FERC 512} + 513)_{2009} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2009}} \right) + \\ & \left( (\text{Start Cost FERC 512} + 513)_{2008} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2008}} \right) + \dots \\ & \left( (\text{Start Cost FERC 512} + 513)_{2000} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2000}} \right) \end{aligned}$$

This formula calculates the total number of starts:

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

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*

#### 4.6.1 Configuration Addition Maintenance Adder

For units undergoing a significant system or unit Configuration Addition the use of an additional "Configuration Addition Maintenance Adder" may be included in the determination of the total maintenance adder. It is not intended to be used for upgrades to existing equipment (i.e.: replacement of a standard burner with a low NO<sub>x</sub> burner).

Examples of significant system or unit Configuration Additions may include but are not limited to:

- Installation of Flue Gas Desulfurization (FGD or scrubber) systems
- Activated Carbon Injection (ACI) or other sorbent injection systems
- Installation of SCR or SNCR NO<sub>x</sub> removal systems
- Conversion from open loop to closed loop circulation water systems
- Bag House addition
- Water injection for NO<sub>x</sub> control
- Turbine Inlet Air Cooling

The specific system or unit configuration system change needs to be reviewed by the MMU pursuant to the Cost and Methodology Approval Process and receive final approval thereof prior to the use of a Configuration Addition Maintenance adder.



#### 4.6.2 Calculation of the Configuration Addition Maintenance Adder:

The Configuration Addition Maintenance adder is to be calculated in the same manner as the maintenance cost adder described in this section with the exception that the Configuration Addition Maintenance total maintenance dollars (CATMD) are only the incremental additional costs incurred because of the system or unit configuration change.

As with the current maintenance adder calculation, the adder for year (Y) uses the actual costs beginning with year (Y-1). Therefore, the first year of actual incremental additional expenses will be captured by the **CAMA** in the second year.

Following the initial year of use of the **CAMA**, each additional year's Configuration Addition maintenance cost will be incorporated into the Configuration Addition maintenance adder until the end of the historical maintenance cost period selected for the unit.

To Calculate the Configuration Addition Maintenance Adder, Calculate the solely incremental Maintenance Cost for the Configuration Change. Please note these expenses are purely incremental and adhere to the requirements in section 3.8.1.

Total Configuration Addition Maintenance Dollars =

$$\begin{aligned} & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2010} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2010}} \right) + \\ & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2009} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2009}} \right) + \\ & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2008} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2008}} \right) + \dots \\ & \left( \text{Incremental (FERC 512 + 513 - Start Cost FERC 512 + 513)}_{2000} * \frac{\text{Escalation Index}_{2011}}{\text{Escalation Index}_{2000}} \right) \end{aligned}$$

*Exhibit 11: Fossil Unit's Sample Formula of Configuration Addition Maintenance Adder*

#### 4.6.3 Reductions in Total Maintenance Costs:

While it is expected that the Configuration Addition Maintenance adder will most often be used to cover step increases in maintenance costs, it is also to be used to capture step decreases in maintenance costs resulting from a significant system or unit configuration change that results in a significant reduction in maintenance costs. Any equipment that falls into disuse or is retired because of the configuration change must have its maintenance expenses removed from the historical record used to develop the maintenance adder. An example of a significant system or unit configuration change that may result in a step decrease in qualified maintenance costs includes, but is not limited to, a fuel change from coal to gas fuel.

## 4.7 Synchronized Reserve

**Note:** The information in Section 2.7 contains basic Synchronized Reserve Cost information relevant for all unit types. The following information only pertains to fossil steam units.

Total costs to provide Tier 2 Synchronized reserve from a steam unit shall include the following components:

$$\text{Total Costs Tier 2 Synchronized Reserve ( \$/MW) = } \frac{\text{Heat Rate Increase * Variable Cost Rate}}{\text{MW of Synchronized Reserve}} + \text{Margin (less than \$7.50) + Lost Opportunity Costs}$$

Further information on Tier 1 and Tier 2 Synchronized Reserve can be found in [PJM Manual 11: Scheduling Operations](#). Heat Rate Increase is the incremental increase resulting from operating the unit at lower MW output resulting from the provision of Synchronized reserve service

Total Steam Unit offers must be expressed in dollars per hour per MW of Synchronized Reserve (\$/MWh) and must specify the total MW of Synchronized Reserve offered.

For Example:

	Output	Heat Rate
Steam Unit Full Load:	100 MW	9,000 BTU/kWh
Steam Unit Reduced Load:	70 MW	9,500 BTU/kWh
VOM Rate:	\$0.50/MBTU	
Heat Rate Penalty =	$(9,500 - 9,000)/9,000 = 5.56\%$	
Adjusted VOM =	$\$0.50 * 1.0556 = \$0.5278/\text{MBTU}$	
Steam Unit Reduced Load Heat Input =	$9,500 * 70 / 1000 = 665 \text{ MBTU}/\text{Hr}$	
Heat Rate VOM Penalty =	$(\$0.5278/\text{MBTU} - \$0.50/\text{MBTU}) * 665 \text{ MBTU}/\text{Hr} = \$18.487/\text{Hr}$	
Synchronized Reserve VOM Adder =	$\$18.487/\text{Hr} / (100 \text{ MW} - 70 \text{ MW}) = \$0.6162/\text{Synchronized MW}$	

*Exhibit 12: Steam Unit Synchronized Reserve Example*

## 4.8 Regulation

**Note:** The information in Section 2.8 contains basic Regulation Cost information relevant for all unit types including fossil steam units.

## Section 6: Combustion Turbine (CT) and Diesel Engine Costs

This section details specific information for the cost development of units that are Combustion turbines or diesel engines.

**Combustion Turbine Unit** – A generating unit in which a natural gas or oil fired combustion turbine engine is the prime mover for an electrical generator. Combustion Turbines that fire landfill gas solely or in conjunction with fossil fuels as a prime mover for an electrical generator are considered to be a **Combustion Turbine Unit**.

**Diesel Engine** – A generating unit in which a diesel reciprocating engine is the prime mover for an electrical generator. Reciprocating engines that fire landfill gas solely or in conjunction with fossil fuels as a prime mover for an electrical generator are considered to be a **Diesel Engine**.

### 6.1 Combustion Turbine and Diesel Engine Heat Rate

**Note:** The information in Section 2.1 contains basic Heat Rate information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

For Combustion Turbine generating units, no-load fuel shall be the theoretical or actual fuel burn rate expressed in MBTU/Hr at the point of electric bus synchronization.

### 6.2 Performance Factor

**Note:** The information in Section 2.2 contains basic Performance Factor information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

**'Like' Combustion Turbine Units** - An average performance factor may be calculated and applied for groups of like units burning the same type of fuel. Like includes same primary manufacturer not necessarily engine or generator manufacturer, but one with overall system responsibility. The following are two examples:

- Worthington sells CT's with P&W engines and a GE generator. Worthington would be considered the primary manufacturer.
- Same general frame size - a manufacturer may modify a basic design to produce units with varying capabilities. Units built with such variations may be placed in a may be placed in a single group.

### 6.3 Fuel Cost

**Note:** The information in Section 2.3 contains basic Fuel Cost information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

Combustion Turbine Maintenance Adder is included directly with the individual operating cost components on a \$/hour basis.

### 6.3.1 Combustion Turbine other Fuel-Related Costs

The dollars in FERC Account 547, plus incremental expenses for fuel treatment and pollution control excluding SO<sub>2</sub> and NO<sub>x</sub> emission allowance costs that were not included in Account 547; minus the fuel expenses from FERC Account 151 that were charged into Account 547, all divided by the fuel (heat content or quantity) shifted from Account 151 into Account 547.

### 6.3.2 Total Fuel Related Cost Equation for CTs

$$\begin{aligned} \text{Total Fuel Related Costs for Combustion Turbines} = \\ \text{Basic Fossil Fuel Cost} + \text{Other Fuel Related Cost} + \text{SO}_2 \text{ emission costs} + \text{NO}_x \text{ emission costs} \\ + \text{CO}_2 \text{ emission costs} \end{aligned}$$

**Note:** CT Maintenance Adder is included directly in start, no-load and peak segment components.

## 6.4 Start Cost

**Note:** The information in Section 2.4 contains basic Start Cost information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

Start costs for all combustion turbines and diesel units shall include only the following components:

$$\begin{aligned} \text{Start Cost } (\$/\text{start}) = \\ \left( \text{Start Fuel Consumed } (\text{MBtu}/\text{Start}) * \text{TFRC} (\$/\text{MBtu}) * \text{Performance Factor} \right) \\ + \left( \text{Station Service (MWh)} * \text{Station Service Rate} (\$/\text{MWh}) \right) \\ + \text{Start Maintenance Adder} \left( \frac{\$}{\text{start}} \right) + \text{Start Incremental Labor Cost} \left( \frac{\$}{\text{start}} \right) \end{aligned}$$

TFRC = Total Fuel Related Cost

**Start Fuel Consumed \* Total Fuel Related Cost (TRFC) \* Performance Factor** is the cost of start fuel (basic fuel cost plus fuel handling and other fuel-related costs) from first fire to unit breaker closing, Plus (+) cost of shutdown fuel from unit breaker opening to fuel valve closure (basic fuel cost plus fuel handling and other fuel-related costs).

**Incremental labor costs** are the costs in excess of normal station manning requirements (only when necessary to start a combustion turbine unit).

**Station Service \* Station Service Rate** from initiation of start sequence to breaker closing (total station use minus normal base station use) priced at the Station Service rate. Plus (+) station service after breaker opening during shutdown (station service during shutdown should be that associated with the normal unit auxiliary equipment operated during shutdown in excess of base unit use, this station service is not to include maintenance use or non-normal uses) priced at the Station Service rate.

NOTE: Starting Maintenance Cost, please see section 6.6.3

**Reminder:** CT Maintenance Adder is included directly in start, no-load and peak segment components.

## 6.5 No Load Cost Calculation for CTs

**Note:** The information in Section 2.5 contains basic Start Cost information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

**Note:** CT Maintenance Adder is included directly in start, no-load and peak segment components.

## 6.6 Maintenance Cost

**Note:** The information in Section 2.6 contains basic Maintenance Cost information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

**Combustion Turbine - Maintenance Adder** – The total dollars from FERC Account 553 divided by Equivalent Service Hours (ESH).

**Industrial Combustion Turbine** – This is a combustion turbine developed specifically for power generation.

**Aircraft - Type Combustion Turbine** – These are combustion turbines originally designed for aircraft and modified for power generation.

**Diesel - Maintenance Adder** – The total dollars from FERC Account 553 divided by total fuel burned (in MBTUs).

**Combustion Turbine Start** – For calculating combustion turbine maintenance cost, only the number of successful starts to synchronization shall be used. Successful starts should include those at the direction of PJM and for company tests.

**Long Term Maintenance Expenses** – Combustion Turbine and Combined Cycle Plant major inspection and overhaul expenses may be included in variable maintenance expenses regardless of accounting methodology if they meet specific criteria.

In order to be included in variable maintenance expenses, these costs must represent actual expenditures that are due to incremental degradation of generating equipment directly related to generation, starts or a combination of both. Expenditures that are not directly related to such operation may not be included in variable maintenance expense. It must be clear that these costs would have been included in the appropriate FERC Accounts as described in this section. A detailed listing of all proposed long-term maintenance costs must be submitted to the PJM MMU for evaluation and final approval pursuant to the Cost and Methodology Approval Process.

Combustion Turbine and Combined Cycle Plant major inspection and overhaul costs categories include but are not limited to the following:

- Combustion Turbine Generator Inlet Air System
- Inlet Air Filter Replacement
- Evaporative cooling system media replacement
- Mechanical inlet air cooling chiller and pump inspection and overhaul
- Fuel System
- Fuel Gas Compressors Inspection and Overhaul
- Distillate Fuel Pumps Inspection and Overhaul
- Water Treatment
- Resin Replacement
- RO Cartridges Replacement
- Environmental
- SCR and/or CO Reduction Catalyst Replacement
- Combustion Turbine Generator ("CTG")
- Combustion Inspections including Parts, Labor, Rentals and Specialized technical expertise and support
- Hot Gas Path Inspection
- Major Overhaul
- Electric Generator Inspection and Overhaul
- Cooling Tower
- Circulation Pump Inspection and Overhaul
- Cooling Tower Fan Motor and Gearbox Inspection and Overhaul
- Replacement of Cooling Tower Fill and Drift Eliminators

### 6.6.1 Combustion Turbine Maintenance Adder Example

$$\text{Equivalent Hour Maintenance Cost} = \frac{\text{Total Maintenance Dollars}}{\text{Equivalent Service Hours}}$$

(Industrial Unit)

Peak Hours = 200 Hrs

Service Hours = 2000 Hrs

No. of Starts = 300

Peak Pickup = 5 MW

Peak Hours are the hours run above base load temperature rating.

Total Maintenance Dollars = \$100,000

(Actual historical maintenance data escalated to present value).

Cyclic Starting Factor = 10, Cyclic Peaking Factor = 3 (Note: Cyclic Starting Factor = 5 for aircraft engine CT's).

$$\begin{aligned} \text{Equivalent Hourly Maintenance Cost (EHMC)} &= \frac{\$100,000}{(10 * 300) + 2,000 + (3 * 200)} \\ &= \$17.86/\text{Hr.} \end{aligned}$$

#### Calculation of maintenance rates

$$\begin{aligned} \text{Starting Maintenance Cost} &= \text{Cyclic Starting Factor} * \text{Equivalent Hourly Maintenance Cost} \\ &= 10 * \$17.86 = \$178.60 \text{ per start} \end{aligned}$$

$$\text{Hourly Maintenance Rate} = \text{Equivalent Hourly Maintenance Cost} = \$17.86/\text{hour}$$

$$\begin{aligned} \text{Peak Incremental Maintenance Rate} \\ &= \frac{\text{Cyclic Starting Factor}}{\text{Peak Pickup}} * \text{Equivalent Hourly Maintenance Cost} \\ &= \frac{3 * \$17.86}{5} \end{aligned}$$

= \$10.72 per MWh

*Exhibit 14: Combustion Turbine Maintenance Cost Adder Example*

### 6.6.2 Combustion Turbine Long Term Service Contract Cost Recovery

A generation owner that has a currently effective Long Term Service Contract (LTSA) with a third party vendor to provide overhaul and maintenance work on a Combustion Turbine (CT) may file a request for inclusion of any variable long term maintenance costs in cost based offer bids, pursuant to the Cost and Methodology Approval Process if the following conditions are met:

- The included variable long-term maintenance costs are consistent with the definition of such costs in the Cost Development Guidelines
- And the dollar value of each component of the variable long-term maintenance costs is set specifically in the LTSA.

### 6.6.3 Equivalent service hours (ESH)

The estimated hours the unit will run based on history.

$$\begin{aligned} \text{Equivalent Service Hours} = & \\ & (\text{Cyclic Starting Factor} * \text{Number of Starts}) + \text{Total Operating Hours at any load level} \\ & + (\text{Cyclic Peaking Factor} * \text{Number of Hours above Base load temperature limit}) \end{aligned}$$

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.



#### 6.6.4 Diesel Incremental Maintenance Adder Calculation

The incremental Maintenance Adder for diesel units will be calculated and applied on a "per MBTU (or other unit of fuel)" basis. The calculation will be based on actual operation and escalated maintenance expenses for all available history in the Maintenance Period.

### 6.7 Synchronized Reserve: Costs to Condense

**Note:** The information in Section 2.7 contains basic Synchronized Reserve Cost information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.

Total synchronous condensing costs for combustion turbines and diesel units shall include the following components:

- **Start costs** if applicable, shall be applied when a unit moves from cold to condensing operations and when a unit moves from condensing operations to energy generation, but shall not be applied when a unit moves from energy generation to condensing operations.
- **Variable Operating and Maintenance cost (EHMC)** in \$/Hr divided by the Synchronized MW provided.
- **Actual cost of power consumed during condensing operations** at real time bus LMP as determined by Market Settlements. MW consumed must be included in the offer.
- **Margin** up to \$7.50 per MW of Synchronized, reserve service provided.

The combustion turbine condensing offers must be expressed in dollars per hour per MW of Synchronized Reserve (\$/MWh) and must specify the total MW of Synchronized Reserve offered.

### 6.8 Regulation Cost

**Note:** The information in Section 2.8 contains basic Regulation Cost information relevant for all unit types. The following additional information only pertains to CT and diesel engine units.