Equivalent Service Hours and Cyclic Maintenance Factors

CDS

April 14, 2021

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Maintenance Expenses

- **Competitive offers are equal to the short run marginal cost.**
- **The IMM does not agree that maintenance expenses are short run marginal costs.**
- **The IMM is providing the following clarification and recommendations to avoid improper accounting of maintenance costs in CTs and CCs.**

Equivalent Service Hours

- **Manual 15 allows the allocation of maintenance expenses using equivalent service hours for CCs/CTs.**
- **Equivalent service hours are used by OEM to determine when certain maintenance on the combustion turbine has to be performed. For example:**
  - **Combustion inspection**
  - **Hot gas path inspection**
  - **Major overhaul**

Equivalent Service Hours

- **Manual 15 includes a formula to calculate equivalent service hours as:**

  ESH = Cyclic Starting Factor x No. of starts +

  Total Operating Hours at any load level +

  Cyclic Peaking Factor x No. of hours above base load

- **Manual 15 also states that only OEM cyclic factors can be used.**
- **In some cases, the formula in Manual 15 is inconsistent with the way that OEMs determine the maintenance intervals.**

OEM Maintenance Events

- **OEMs have different equations and triggers for maintenance events.**
  - **Some may have it based on total equivalent service hours (including starts) as in Manual 15.**
  - **Some may have it based on the trigger that occurs first, between number of starts or number of factored hours (i.e. similar to the Manual 15 equation but excluding starts).**
  - **Some may include dual fuel operation.**
  - **Some may include fast starts and/or trips.**

Example

- **Unit A and B have 200 starts, 1,900 operating hours at base load and 20 hours at peak load (10 MW).**
  - **Unit A is a X model.**
  - **Unit B is a Y model.**
- **X OEM documentation states that maintenance intervals are measured in equivalent service hours and that an equivalent service hour is equal to:**
  - **ESH = Starts x 15 + Base Load Hours + Peak Load Hours x 5**
- **X OEM states that a combustion inspection should be performed every 5,000 ESH.**

Example

- The combustion inspection cost $100,000.
- The CI cost per ESH is $20 per ESH or
  - Every start costs $20 x 15 (cyclic factor) = $300
  - Every hour at base costs $20 x 1 (base load) = $20
  - Every hour at peak costs $20 x 5 (peaking factor) = $100
- In the three part offer this will be:
  - Start Cost: $300/start
  - No Load: $20/hour
  - Peak MW Incremental Offer: ($100 - $20) / 10 MW = $8/MWh

Example

- **Unit A and B have 200 starts, 1,900 operating hours at base load and 20 hours at peak load (10 MW).**
  - **Unit A is a X model.**
  - **Unit B is a Y model.**
- **Y OEM documentation states that maintenance intervals are measured in starts and equivalent hours.**
  - **Starts = No. of starts**
  - **Equivalent hours = Base Load Hours + Peak Load Hours x 3**
- **Y OEM states that a combustion inspection should be performed every 200 starts or 4,000 equivalent hours, whatever happens first.**

Example

- **The combustion inspection cost $100,000.**
- **Since the number of starts was triggered first, the CI cost per start is $500. Base load or peak load hours did not trigger the maintenance event, therefore there is no CI cost associated with running at base load or peak load.**
- **In the three part offer this will be:**
  - **Start Cost: $500/start**
  - **No Load: $0/hour**
  - **Peak MW Offer: $0/MWh**

Issues

- **The equation in Manual 15 can differ from the equation used by the OEM. Just like the cyclic factors, Manual 15 should require the use of the OEM.**
- **This maintenance expense allocation method should only be allowed for generators that follow the OEM equations and maintenance intervals.**
- **Only maintenance expenses attributed to combustion turbine (e.g. Combustor Inspection) should be allocated using this method. Other maintenance expenses (e.g. BoP, steam turbine) should not.**

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