Opportunity Cost Calculator

MRC
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Opportunity Cost Definition

- **Opportunity costs are the value of a foregone opportunity.**
- **Opportunity costs may result when a unit:**
  - **Has limited run hours due to an externally imposed environmental limit**
  - **Is requested to operate for a constraint by PJM and is offer capped.**
- **Opportunity costs are the net revenue from a higher price hour that are foregone as a result of running at PJM's request during a lower price hour.**

Opportunity Cost Definition

- **Opportunity costs may be added to a cost-based offer for units with a documented externally imposed environmental regulation based run-hour restriction.**
- **Examples Include:**
  - **Limit on total emissions**
  - **Direct run-hour restriction**
  - **Heat input limitation**
- **Market Participants may elect to enter their cost-based offer with an opportunity cost component which may be a value less than or equal to their calculated opportunity cost.**

Opportunity Cost Calculation Method

- **Methodology uses forward prices for power and fuel costs and an historical basis period to determine the value of future net revenue for run-hour restricted units**
- **Opportunity cost is calculated using an historical average of the previous three years, combined with forward prices of fuel, electricity, and emission allowances to project the year's LMP at a pricing node.**

Issue

- **The Manual M-15 which is currently in place (Approved Manual) does not establish a method for the calculation of opportunity cost that is as accurate as it could be.**
- **The MMU has recommended specific changes to the manual in order to improve the method and make it more accurate.**
- **The CDTF has reviewed the MMU's proposed changes in detail at multiple meetings and calls.**
- **The CDTF has approved all but one of the MMU's proposed changes.**

Issue

- **The MMU is requesting that the MRC review and approve the CDTF proposals.**

Primary Differences Between MMU Method and the Approved Manual

	MMU
Rolling Time Period Restrictions	√
Dual Fuel Inputs	√
Spot or Contract Monthly Fuel Flexibility	√
Minimum Run Time	√
Start Up Costs	√
Adjustment for Negative Margins	√
Delivery Adder	√

Opportunity Cost Manual Changes

	Recommended by CDTF	Passed by MC
Rolling Time Period Restrictions	√	√
Duel Fuel Inputs	√	√
Spot or Contract Monthly Fuel Flexibility	√	√
Minimum Run Time	√	
Start-Up Costs	√	
Adjustment for Negative Margins		
Delivery Adder		

MMU Calculation Tool

- The MMU currently has an operating web based tool to calculate opportunity cost as described in the MMU red line to Manual M-15
- Inputs gathered by web portal
- Login with eFuel account
- Easy to use
- Historical / futures data gathered from PJM and MMU databases
  - No need for users to input
- Changes to calculator can be implemented and tested with no impact on users
  - No requirement for additional data entry

Ability to Handle Rolling Time Period Restrictions

- **Approved Manual does not address rolling time period restrictions**
- **This feature has been approved by Member's Committee**
- **Large percentage of units having emission limitations have rolling time period restrictions**
- **Change to manual:**
  - **Account for restrictions based on calendar year or rolling 12 months, depending on actual environmental limits**

Dual Fuel Inputs

- **Approved Manual does not address use of dual fuel inputs**
- **This feature has been approved by Member's Committee**
- **Change to manual:**
  - **Permits use of dual fuels for units that may burn multiple fuels**
  - **For units with restrictions on consumption of specific fuels, this method allows accounting for both fuels in the same calculation.**
  - **Example:**
    - **Run hour restriction of combined gas and oil output**
    - **Unit has restriction only when burning secondary fuel**

Spot or Contract Monthly Fuel Flexibility

- **Approved Manual does not address flexibility to use spot or contract monthly fuel costs**
- **This feature has been approved by Member's Committee**
- **Change to manual:**
  - **Flexibility to choose spot price for one fuel and contract price for another fuel or another time period**
  - **Allows members to identify when a contract will end**
    - **If contract ends in the middle of a compliance period, permits use of spot prices or new contract prices**
  - **No need for participants to input fuel spot prices**

Minimum Run Time

- **Approved Manual does not account for minimum run time limits**
- **This feature has been recommended for implementation by the CDTF**
- **Proposed change to manual:**
  - **Account for minimum run time parameter limit for each unit**
  - **Minimum run time has an impact on calculated opportunity costs**
  - **Inclusion of minimum run time parameter improves accuracy of calculation based on actual unit parameters**
  - **For minimum run time, the adder is the average hourly adder for a block of hours, rather than the minimum hourly adder for the remaining run hours**

Start Costs

- Approved Manual does not account for start costs
- This feature has been recommended for implementation by the CDTF
- Proposed change to manual:
  - Account for start costs for each unit
  - Start costs are a cost of operation and have an impact on calculated opportunity costs
  - Inclusion of start costs improves accuracy of calculation based on actual unit costs

Proposed Start Costs by Unit Type

- **Treatment of start costs based on unit types:**
  - **Steam units modeled may use “Hot” start costs rather than “Cold” start costs**
  - **CT and CC units should use “Cold” start costs as these units are likely to use this cost in actual dispatch**
  - **Units can request exceptions based on documented operating practices/history**

Negative Margins

- **Calculation of opportunity costs uses both future fuel and electricity prices and historical data to calculate the margin (LMP minus cost) by hour and by bus**
- **Three years of historical data is used to provide hourly detail and bus detail because future data is not adequately granular**
- **Negative margins occur during specific hours and at specific buses when cost was greater than LMP**
- **Hours of negative margin do not reflect hours when a generator was running**

Negative Margins

- **Approved Manual does not account for negative margins**
  - **Sets negative margin equal to zero prior to averaging**
- **Proposed change to manual:**
  - **Negative margins reflect actual margins from prior years and should be included in calculation**
  - **Accurately accounts for actual market results by hour/bus**
  - **Example:**

700th Margin (2006) = -$100
700th Margin (2007) = -$100
700th Margin (2008) = $75

Maximum Opportunity Cost Component
MMU Method = Max(0, -$41.67) = $0
Approved Manual Method = $25

Fuel Delivery Adder

- Approved Manual does not account for delivery charges of fuel
- As units are not located at trading hub, this adder is needed to enhance accuracy of fuel prices
- Delivery adder is provided by market participants, subject to MMU review
- Proposed change to manual:
  - Fixed delivery adder is added to forward prices in calculation.

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