Opportunity Cost Calculator

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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 when such limitations exist.**

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 MMU is requesting that the MRC review and approve the CDTF proposals regarding the calculation method for opportunity costs related to environmental limitations.**

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	√	

Minimum Run Time

- **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

- **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**

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

- **This feature has been recommended for implementation by the CDTF**
- **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

- **This feature has been recommended for implementation by the CDTF**
- **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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