Opportunity Cost Calculator

CDTF
April 19, 2010

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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.**

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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.**

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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.**

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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 voted to approve the MMU approach and then the CDTF voted not to approve the specific proposal.**

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

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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	√

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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**

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MMU Input Screen

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Sample MMU Output Screen

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Automatic Updates

- **Calculator saves inputs from previous days, including outages**

- **Automatically updates hours run, without required input from participants**

- **Recalculates opportunity cost adder daily, without required input from participants**

- **No need for participant changes unless units change fuel or outage schedule**

- **Daily automatic updates posted overnight**

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Ability to Handle
Rolling Time Period Restrictions

- **Approved Manual does not address rolling time period restrictions**

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

- **Large percentage of units having emission limitations have rolling time period restrictions**

- **Proposed change to manual:**

  - **Account for restrictions based on calendar year or rolling 12 months, depending on actual environmental limits**

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Dual Fuel Inputs

- **Approved Manual does not address use of dual fuel inputs**

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

- **Proposed 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**

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Spot or Contract Monthly Fuel Flexibility

- **Approved Manual does not address flexibility to use spot or contract monthly fuel costs**

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

- **Proposed 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**

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Minimum Run Time

- **Approved Manual does not account for minimum run time limits**

- **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**

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Start Costs

- **Approved Manual does not account for start costs**

- **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**

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Proposed Start Costs by Unit Type

- **Treatment of start costs based on unit types:**
  - **Combined Cycle units modeled as cycling units may use "Hot" start costs rather than "Cold" start costs**
  - **CT and Steam units should use "Cold" start costs as these units are likely to use this cost in actual dispatch**
  - **Exception process based on documented operating practices/history**

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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**

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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

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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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