Building the Energy Markets of Tomorrow . . . Today

DAMAP Computation

Draft – for discussion purposes only

July 23, 2004

Introduction

- ✓ Current DAMAP calculation will be modified to include Reserve and Regulation, as well as Energy
- ✓ Calculation includes the concept of an Economic Operating Point (EOP)
- ✓ Unit de-rates will need to account for modifications to the DAM Energy, Reserve and Regulation schedules

Eligibility for DAMAP

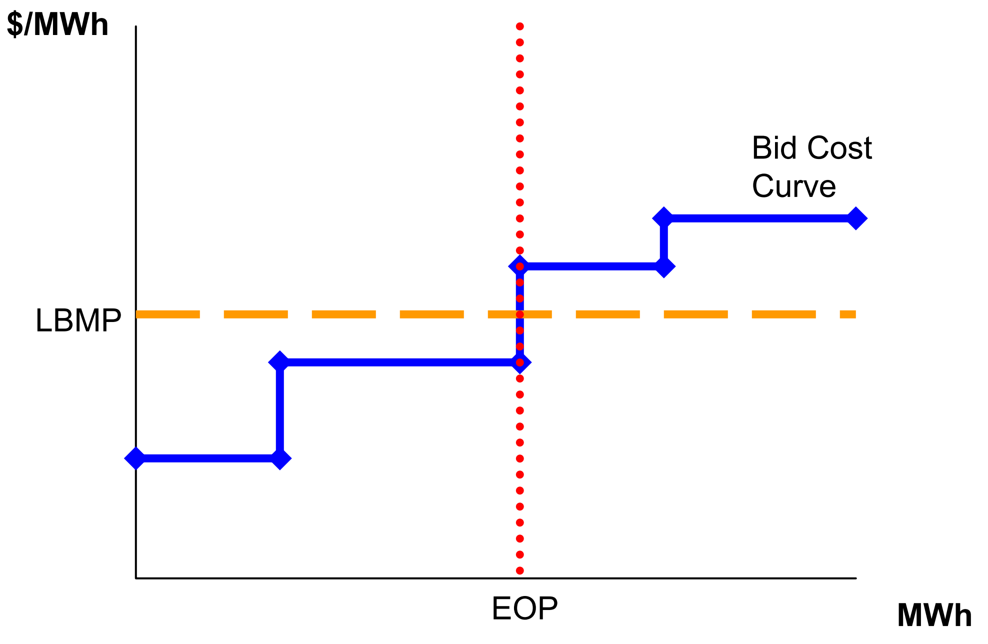
- ✓ Units bid as the following shall be eligible for DAMAP:
  - *ISO Committed Flexible*
  - *Self Committed Flexible*
  - *All current DAMAP eligibility rules that apply to today's On-Dispatch units shall apply*
- ✓ Self and ISO Committed Fixed units are not eligible for DAMAP unless scheduled by the ISO or TO out of economic order in response to a system security need.

Calculation Procedure

- ✓ Step 1: Determine the EOP
- ✓ Step 2: Calculate the DAM schedule reductions in the event of a de-rate
- ✓ Step 3: Calculate adjusted DAM schedules
- ✓ Step 4: Determine the lower and upper limits used in the Energy contribution calculation
- ✓ Step 5: Calculate the Energy contribution to DAMAP
- ✓ Step 6: Calculate the Reserve products contribution to DAMAP
- ✓ Step 7: Calculate the Regulation contribution to DAMAP
- ✓ Step 8: Calculate the contribution to DAMAP from interval *i* to hour *h*
- ✓ Step 9: Calculate the DAMAP for hour *h*

Step 1: Determine the EOP

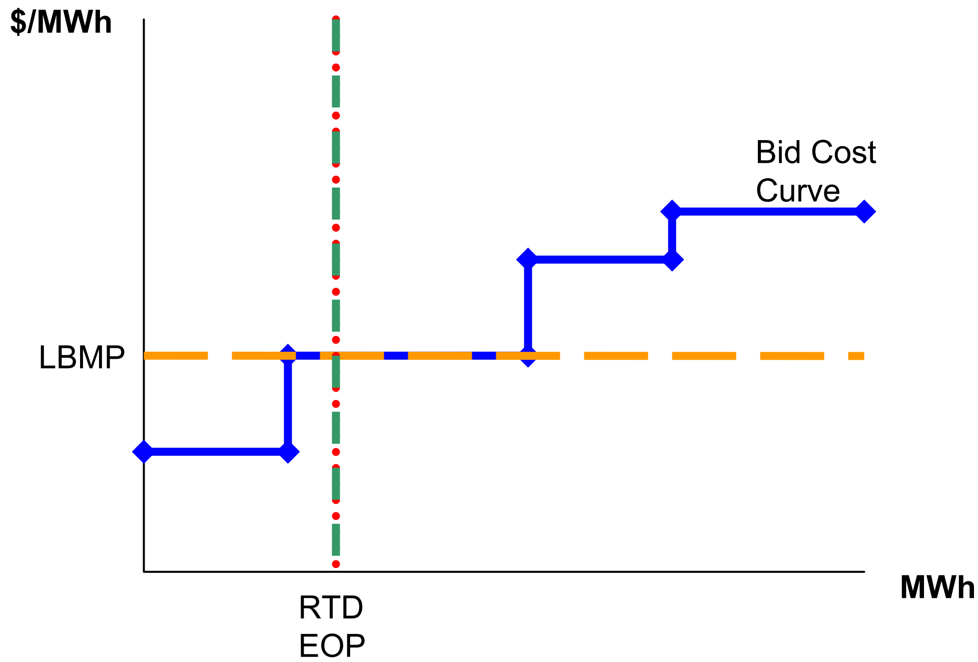
Definition: The EOP is defined as the point where the LBMP intersects the Supplier's bid cost curve.



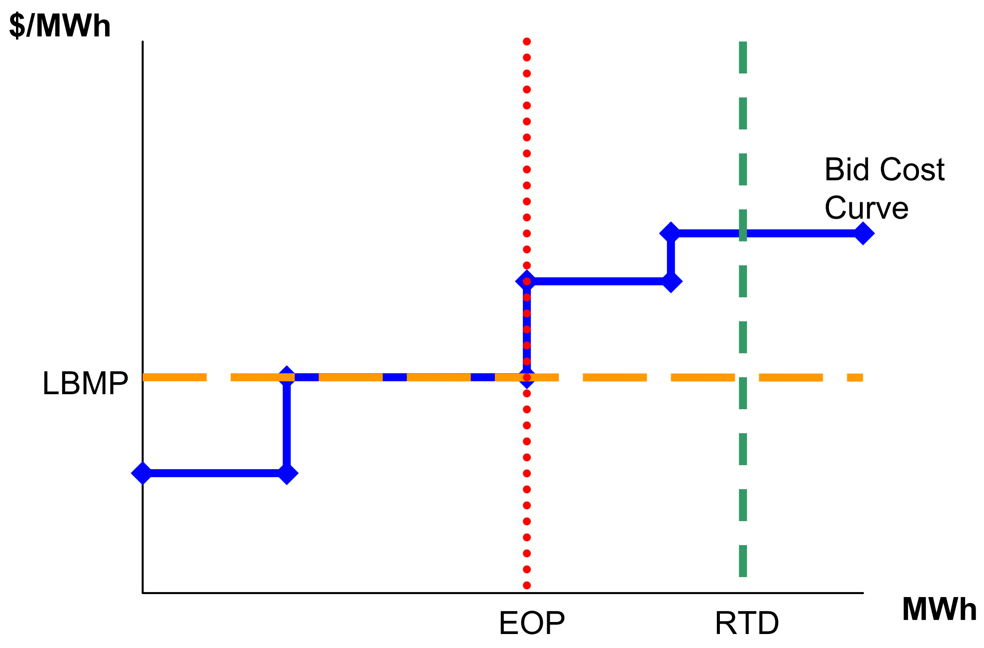
What if….

- ✓ The LBMP intersects at a horizontal portion of the curve?
- ✓ The rule is as follows:
  - *If the RTD basepoint is at a point on the curve that is equal to the LBMP intersect, the EOP shall be the same as the RTD basepoint.*
  - *If the RTD basepoint is at a point on the curve that is higher than the LBMP intersect, the EOP shall be at the maximum of the horizontal step.*
  - *If the RTD basepoint is at a point on the curve that is lower than the LBMP intersect, the EOP shall be at the minimum of the horizontal step.*

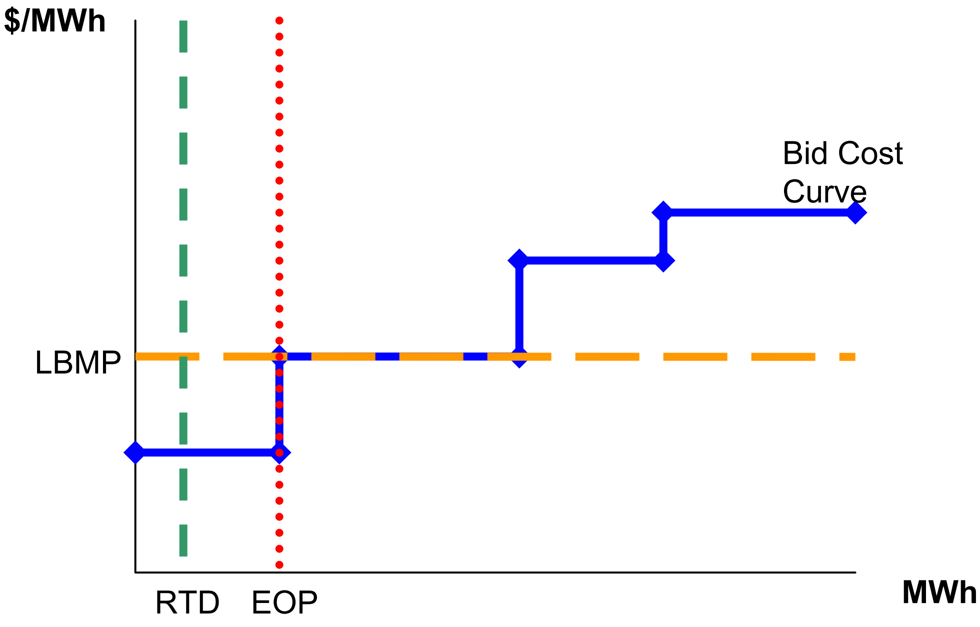
RTD Basepoint = LBMP Intersect



RTD Basepoint > LBMP Intersect



RTD Basepoint < LBMP Intersect



Step 2: Calculate DAM Schedule Reductions in the Event of a De-rate

- ✓ 2A: Calculate the **total** DAM schedule reduction for RTD interval *i.*
- ✓ *2B: Calculate the **potential** reduction for **each product** for RTD interval i.*
- ✓ *2C: Calculate the **actual** reduction for **each product** for RTD interval i*.

Step 2A: Total Reduction

$$REDtot_i = Max(DASen_h + DASreg_h + \sum_p DASres_{hp} - RTuol_i\ ,\ 0)$$

Where:

$REDtot_i$ = Total MW reduction of DAM schedules for interval *i.*

$DASen_h$ = DAM schedule for Energy for hour *h* containing interval *i*

$DASreg_h$ = DAM schedule for Regulation for hour *h* containing interval *i.*

$DASres_{hp}$ = *DAM schedule for Reserve product p for hour* h *containing interval* i

Step 2B: Calculate Potential Product Reduction

$$POTREDen_i = Max(DASen_h – RTSen_i , 0)$$

$$POTREDreg_i = Max(DASreg_h – RTSreg_i , 0)$$

$$POTREDres_{ip} = Max(DASres_{hp} – RTSres_{ip} , 0)$$

Where:

- $POTREDen_i$ = Potential reduction in the DAM Energy schedule for interval *i*.
- $RTSen_i$ = Real time schedule for Energy for interval *i*.
- $POTREDreg_i$ = Potential reduction in the DAM Regulation schedule for interval *i*.
- $RTSreg_i$ = Real time schedule for Regulation for interval *i*.
- $POTREDres_{ip}$ = Potential reduction in the DAM Reserve, product *p* schedule for interval *i.*
- $RTSres_{ip}$ = Real time schedule for Reserve, product *p*, for interval *i*.

Step 2C: Calculate Actual Reductions

If: $REDtot = 0$

$REDen_i = 0$

Where $REDen_i$ = Actual reduction in the DAM Energy schedule for interval *i.*

$REDreg_i = 0$

Where $REDreg_i$ = Potential reduction in the DAM Regulation schedule for interval *i*.

$REDres_{ip} = 0$

Where $REDres_{ip}$ = Potential reduction in the DAM Reserve, product p schedule for interval *i*.

Step 2C, Cont.

Else:

$$REDen_i = [POTREDen_i / (POTREDen_i + POTREDreg_i + \sum_p POTREDres_{ip})] \times REDtot_i$$

$$REDreg_i = [POTREDreg_i / (POTREDen_i + POTREDreg_i + \sum_p POTREDres_{ip})] \times REDtot_i$$

$$REDres_{ip} = [POTREDres_{ip} / (POTREDen_i + POTREDreg_i + \sum_p POTREDres_{ip})] \times REDtot_i$$

Step 3: Calculate Adjusted DAM Schedules

$AdjDASen_i = DASen_h - REDen_i$

Where $AdjDASen_i$ = Adjusted DAM Energy schedule for interval *i*.

$AdjDASreg_i = DASreg_h - REDreg_i$

Where $AdjDASreg_i$ = Adjusted DAM Regulation schedule for interval *i*.

$AdjDASres_{ip} = DASres_{hp} - REDres_{ip}$

Where $AdjDASres_{ip}$ = Adjusted DAM Reserve, product *p*, schedule for interval *i*.

Step 4A: Determine Lower Limits used in the Energy Contribution Calculation

If: $RTSen_i < EOP_i$,

$LL_i = Max[RTSen_i, Min(Act_i, EOP_i)]$, but not more than $AdjDASen_h$

Else:

$LL_i = Min[RTSen_i, Max(Act_i, EOP_i)]$, but not more than $AdjDASen_h$

Where:

LL_i = Lower Limit to be used in the Energy contribution calculation for interval *i*.

EOP_i = The EOP for interval *i*.

Step 4B: Determine Upper Limits used in the Energy Contribution Calculation

If: $RTSen_i \geq EOP_i \geq AdjDASen_h$,

$UL_i = Min[RTSen_i , Max(Act_i , EOP_i)]$, but not less than $AdjDASen_h$

Else:

$UL_i = Max[RTSen_i , Min(Act_i , EOP_i)]$, but not less than $AdjDASen_h$

Where:

UL_i = Upper Limit to be used used in the Energy contribution calculation for interval *i*.

Step 5: Calculate the Energy Contribution to DAMAP

If: $RTSen_i < AdjDASen_h$

$$CDMAPen_i = \left\{ \left(AdjDASen_h - Max\left[RTSen_i, Min\left(Act_i, LL_i \right) \right] \right) \times LBMP_{RT_i} - \int_{Max\{RTSen_i, Min(Act_i, LL_i)\}}^{AdjDASen_h} DABen_h \right\}$$

Else:

$$CDMAPen_i = Min \left\{ \left[AdjDASen_h - UL_i \right] \times LBMP_{RT_i} + \int_{AdjDASen_h}^{UL_i} RTBen_h, 0 \right\}$$

Where:

$LBMP_{RTi}$ = Real-time LBMP at the generator bus for interval *i*.

$RTBen_h$ = Real-Time bid for Energy for hour *h* containing interval *i*.

$CDMAPen_i$ = Energy contribution to DAMAP for interval *i*.

Step 6: Calculate the Reserve Products Contribution to DAMAP

If: $RTSres_{ip} < AdjDASres_{hp}$

$CDMAPres_{ip} = (AdjDASres_{hp} – RTSres_{ip})\ X\ (RTPres_{ip} – DABres_{hp})$

Else:

$CDMAPres_{ip} = (AdjDASres_{hp} – RTSres_{ip})\ X\ RTPres_{ip}$

Where:

$RTPres_{ip}$ = Real-time price for Reserve product *p* for interval *i*.

$CDMAPres_{ip}$ = Reserve product *p* contribution to DAMAP for interval *i*.

Step 7: Calculate the Regulation Contribution to DAMAP

If: $RTSres_{ip} < AdjDASres_{hp}$

$CDMAPreg_i = (AdjDASreg_h – RTSreg_i) X (RTPreg_i – DABreg_h)$

Else:

$CDMAPreg_i = (AdjDASreg_h – RTSreg_i) X Max[(RTPreg_i – RTBreg_h),0]$

Where:

$RTPreg_i$ = Real-time price for Regulation for interval *i*.

$RTBreg_h$ = Real-time bid for Regualtion for hour *h* containing interval *i*.

$CDMAPreg_i$ = Regulation contribution to DAMAP for interval *i*.

Step 8: Calculate the Contribution to DAMAP from Interval *i to Hour* h

$$CDMAP_i = (CDMAPen_i + \sum CDMAPres_{ip} + CDMAPreg_i) \text{ X } (Int_i/3600)$$

Where:

Int = Length of RTD interval *i* in seconds

$CDMAP_i$ = RTD interval *i* contribution to DAMAP for hour *h*

Step 9: Calculate the DAMAP for Hour *h*

Finally,

$$\mathbf{DMAP_h = Max(0, \sum CDMAP_i)}$$

Note, that as today, the DAMAP has a floor of zero.