Regulation Lost Opportunity Cost

Cheryl Mae Velasco
Engineer, Real-Time Market Operations
Regulation Market Issues Sr. Task Force
November 11, 2015

Regulation Lost Opportunity Cost (RegLOC)

RegLOC – is the foregone revenue or increase in costs relative to the energy market for providing regulation

- Calculated only for resources providing energy along with regulation service
- Calculated only for pool scheduled regulation resources
- Is $0 for DSR, and self-schedule and Non-Energy Regulation resources
- Can only be positive, else zero
- Calculated only within Eco limit range
  - Economic Minimum to Economic Maximum range
- RegLOC is a component of the Regulation Market Clearing Price
- Re-evaluating schedule used in the Reg LOC calculation is within the scope of RMISTF

Simplified RegLOC formula

As described in Section 3.2.7 of M-11

$$|LMP - MC| * GENOFF$$

Where:

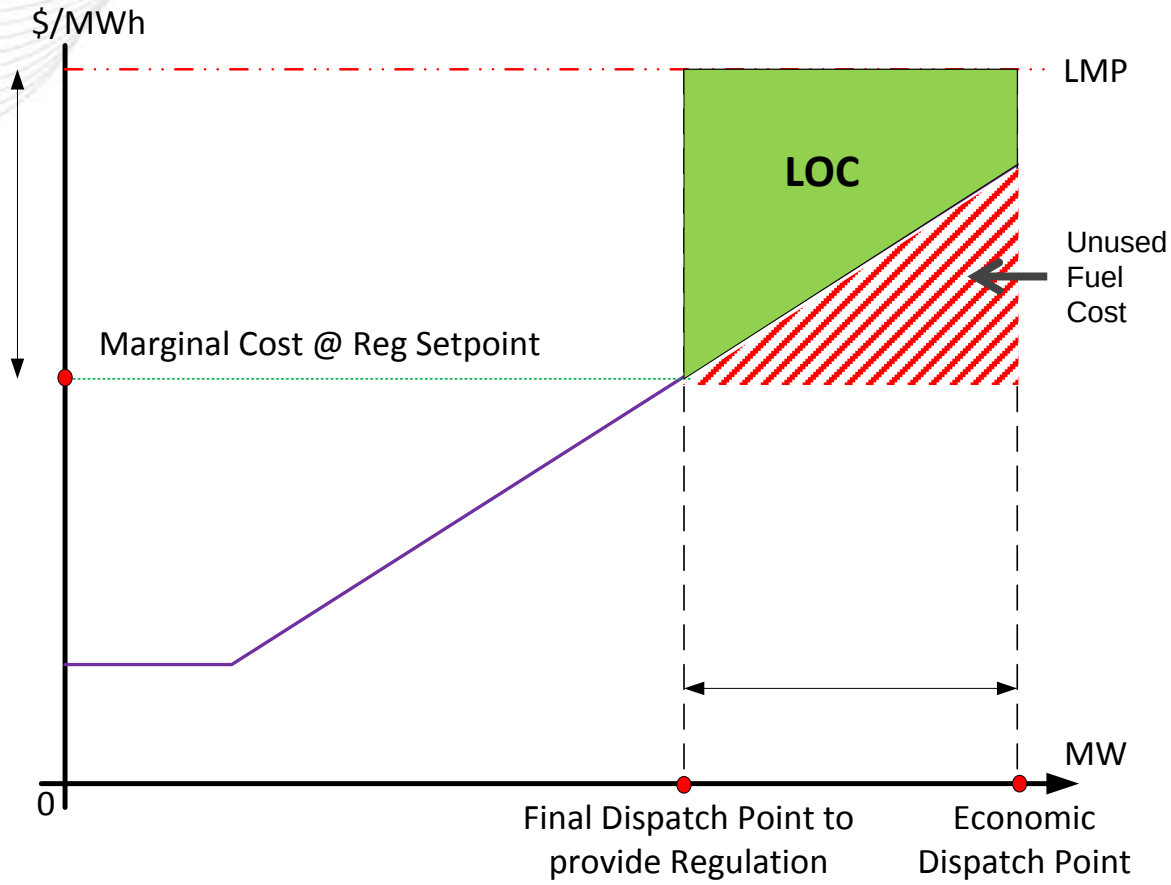
LMP – is the LMP at the resource bus;

MC – is the resource cost at the regulation set point;

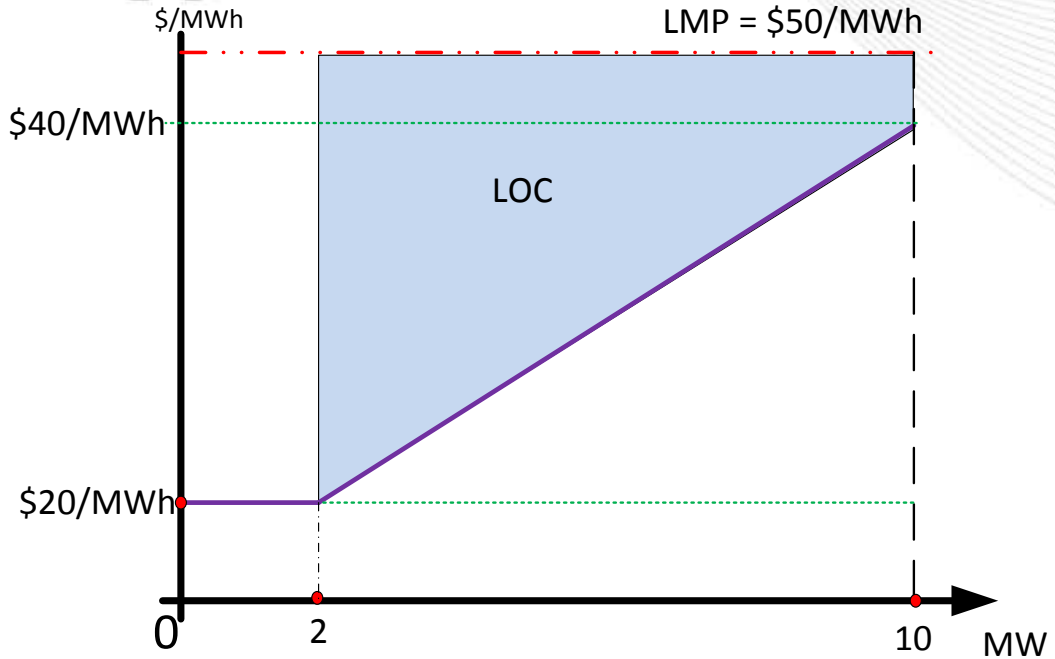
GENOFF – is the MW deviation from the economic dispatch and the regulation set point

Note:

- In the clearing process, forecasted LMP is used
- In the pricing, Real-Time LMP is used
- RegLOC is further adjusted by:
  - Resource Historical Performance Score and
  - Resource Benefit Factor



RegLOC Calculation and Benefit for Participating in Regulation Market



Reg MW = 8 MW
Reg Offer Price = $0
RegMax = EcoMax = 10MW
RegMin = -10 MW
LMP = $50
Energy cost at regulation set-point = $20

- Energy Only - no Regulation
- Energy Credit = LMP*MW = 50*10 = 500
- Energy Cost = (20*10) + (8*20*0.5) = 280
- Energy Revenue = 500 – 280 = 220

- Energy with Regulation
- Energy Credit = 50*2 = 100
- Energy Cost = 20*2 = 40
- Energy Cost not incurred due to RT reduction = (20*8) + (8*20*0.5) = 240
- Energy Revenue = 100 – 40 = 60
- RMCP Credit = 30*8 = 240
- LOC = (10*8) + (20*8*0.5) = 160
- Revenue when Energy with Regulation = 60 + 240 = 300
- There is an increase in margin of $80 for providing Regulation with Energy rather than Energy only

Regulation Lost Opportunity Cost Example

$$RegLOC\ Schedule = Least \begin{Bmatrix} available\ price - based\ energy\ schedule, \\ greatest\ (available\ cost - based\ energy\ schedule \end{Bmatrix}$$

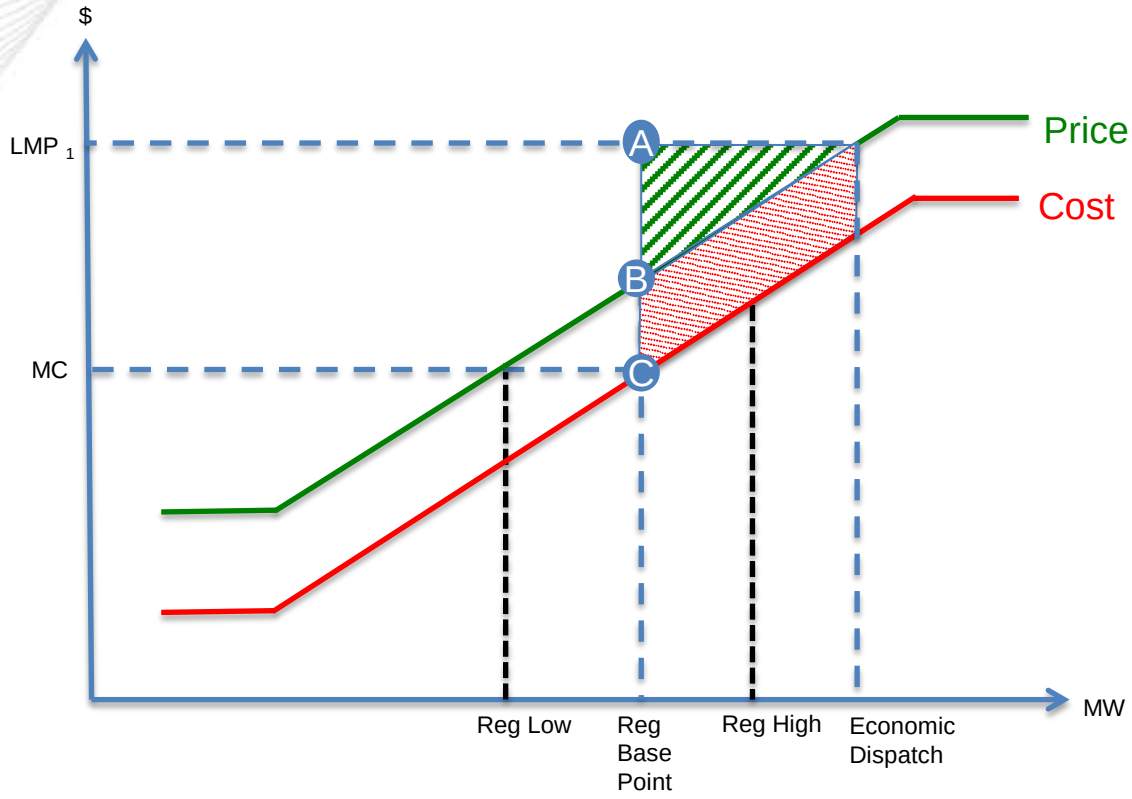
- Unit is running for energy on Price Schedule
- Reg LOC is calculated using Cost Schedule

$$LOC = |LMP_1 - MC| * (Economic\ Dispatch\ - Reg\ Basepoint)$$

$$LOC_{price} = |\$A\ - \$B| * (Economic\ Dispatch\ - Reg\ Basepoint)$$

$$LOC_{cost} = |\$A\ - \$C| * (Economic\ Dispatch\ - Reg\ Basepoint)$$

- Resource is paid the green + red portion
- Resource should only be paid the green portion
- In this case, we are overvaluing the cost of the resource to provide regulation



Regulation Uplift Example

$$RegLOC\ Schedule = Least \left\{ \begin{matrix} available\ price - based\ energy\ scheduled, \\ greatest\ (available\ cost - based\ energy\ schedule \end{matrix} \right\}$$

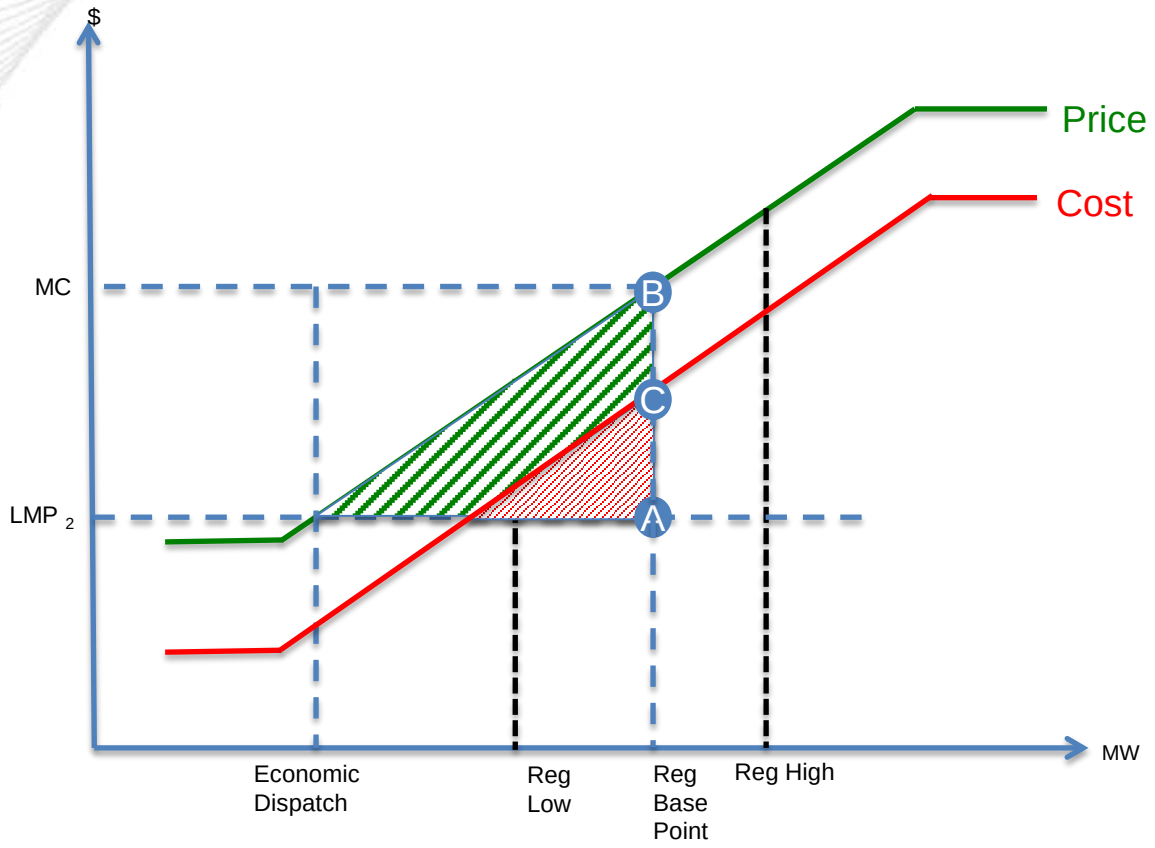
- Unit is running for energy on Price Schedule
- Reg LOC is calculated using Cost Schedule

$$LOC = |LMP_2 - MC| * (Reg\ Basepoint\ - Economic\ Dispatch)$$

$$LOC_{price} = |\$A\ - \$B| * (Reg\ Basepoint\ - Economic\ Dispatch)$$

$$LOC_{cost} = |\$A\ - \$C| * (Reg\ Basepoint\ - Economic\ Dispatch)$$

- Resource is paid the red portion
- Resource should be paid the green + red portion
- In this case, we are undervaluing the cost of the resource to provide regulation



Impacts of Schedule Used in Reg LOC Calculation

- If the marginal resource is backed down uneconomically to provide regulation, the RMCP is likely inflated
- If the marginal resource is raised uneconomically to provide regulation, the RMCP is likely suppressed
  - Resources are still compensated in settlements to cover costs after the fact
- RMCP in these cases may not send the correct market signal