RSG Technical Conference

ER13-2124-000

November 19, 2013

RSG Tech Conference

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- **Session 2: Constraint Management Charge**
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Session 1:

Schedule 46

Question 1: Schedule 46 Process example

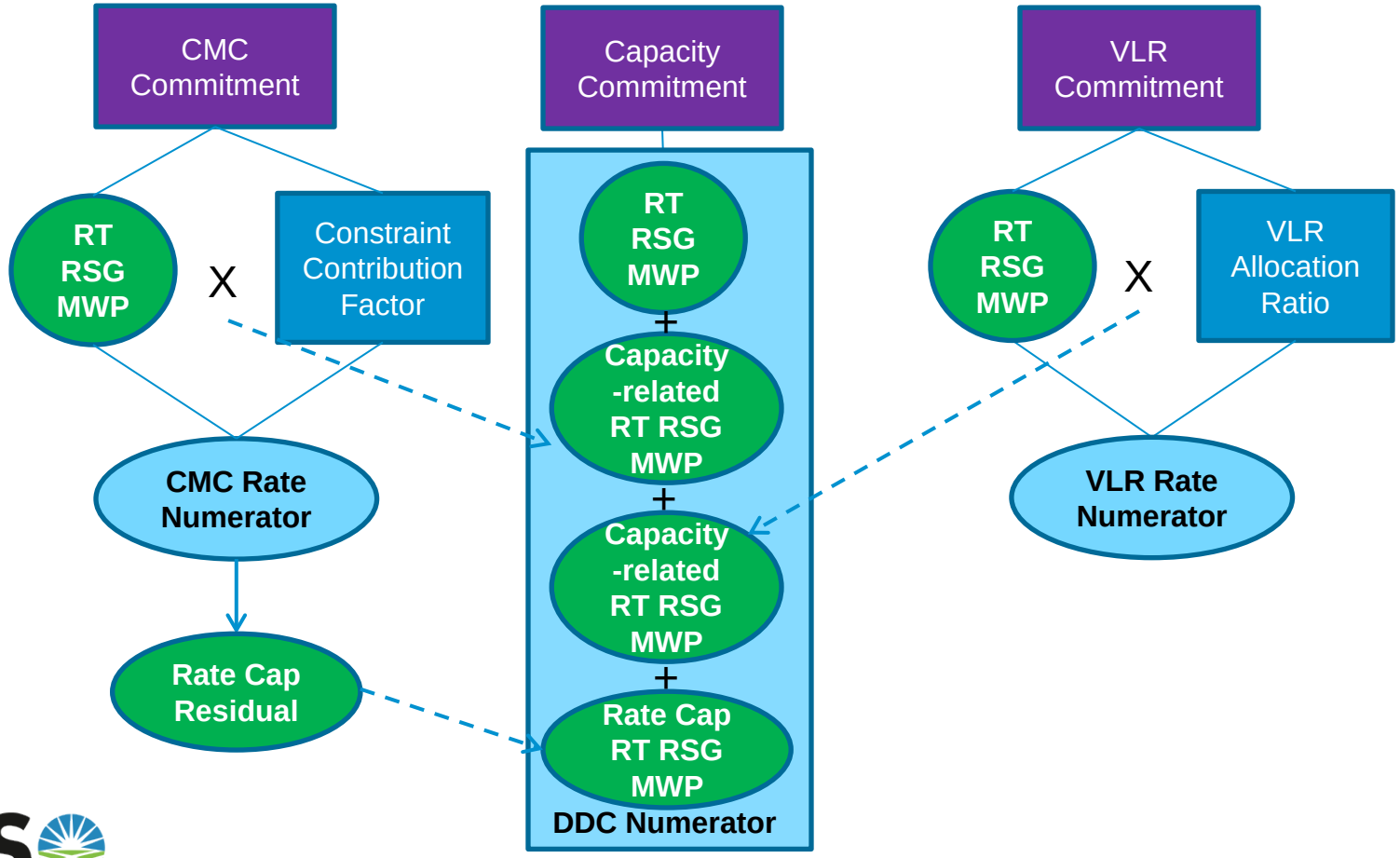
- The purpose of the CMC Allocation Factor Study is to determine the extent to which Resources committed for Active Transmission Constraints (ATCs) reduce the costs that would otherwise have been incurred to satisfy MISO's capacity needs
  - In other words, an allocation factor of 0.9 would indicate that 10 percent of those RSG costs represent the benefit of committing the Resource in reducing capacity costs that MISO would otherwise incur.
- MISO conducts the CMC Allocation Factor Study on a quarterly basis using historical data from the prior year
- The CMC Allocation Factor is applied to RT RSG paid to commitments for Transmission Reliability (also referred to as ATC Management), and not to commitments for capacity or local reliability or voltage support.
- Schedule 46 calculates the CMC Allocation Factor based on the RT RSG MWP of the Resource commitments for ATCs and the least-cost replacement Resource if there is a capacity need in an hour

Please see the Appendix for a numerical example of calculating the CMC Allocation Factor

Question 2: RSG Distribution Flow Chart

Resource commitments are classified as CMC, Economic, or VLR

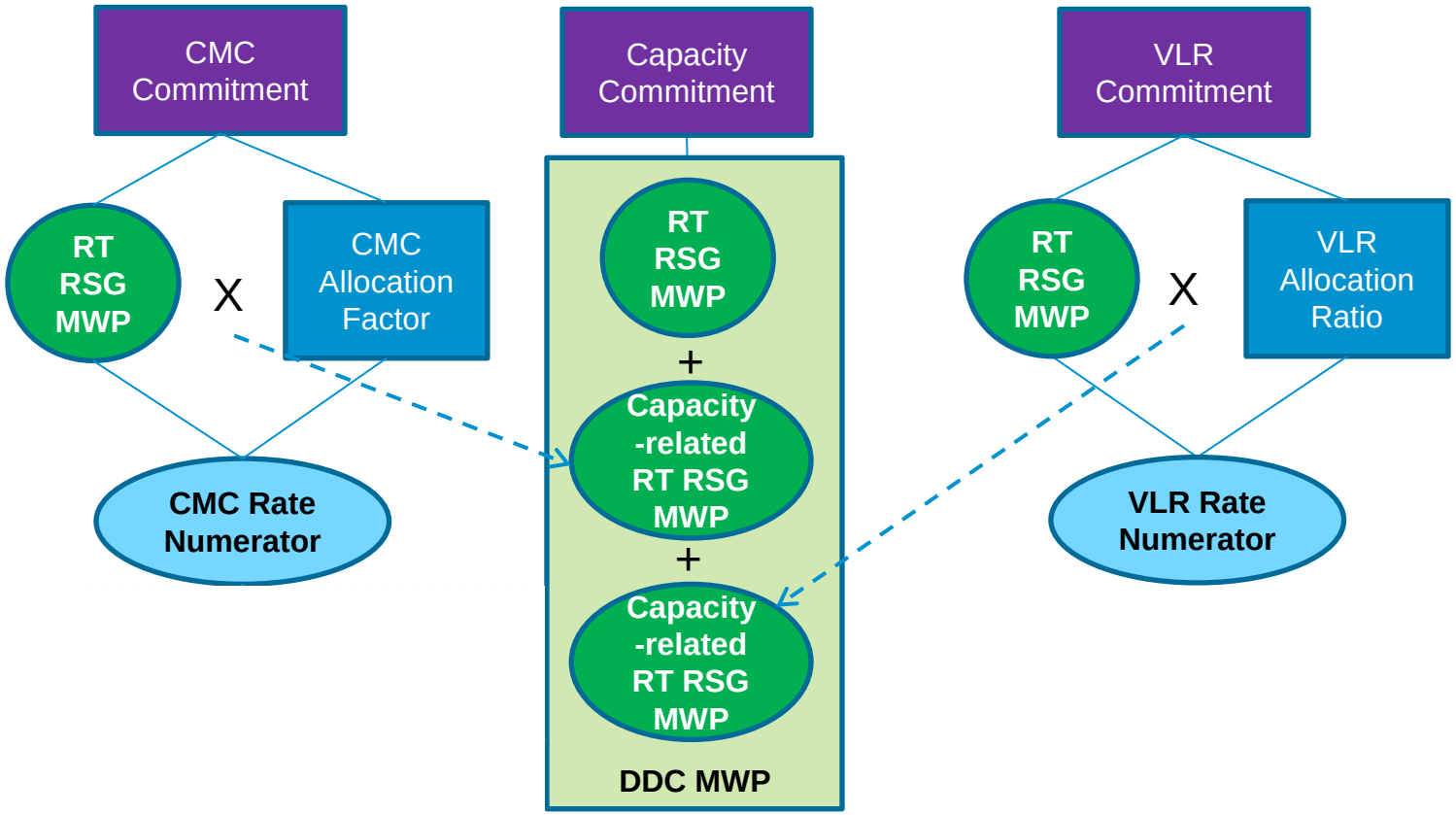
<u>Current</u> RSG Flow Chart



Question 2: RSG Distribution Flow Chart

Resource commitments are classified as CMC, Economic, or VLR

<u>Proposed</u> RSG Flow Chart

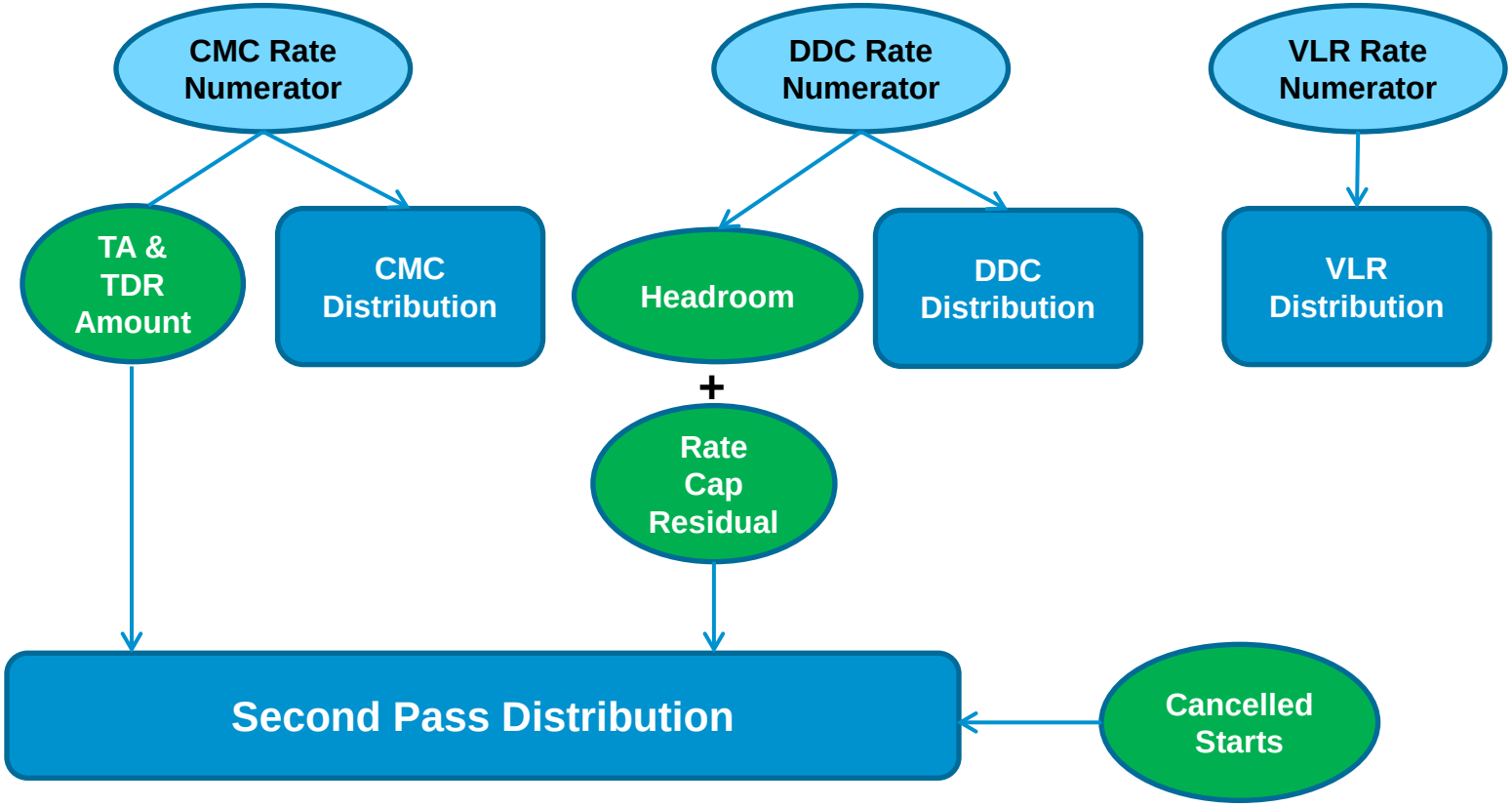


Please see the Appendix for a numerical example of this calculation under the proposed rate methodology

Question 2: RSG Distribution Flow Chart

Once the funds are determined, dollars will be distributed in the following manner:

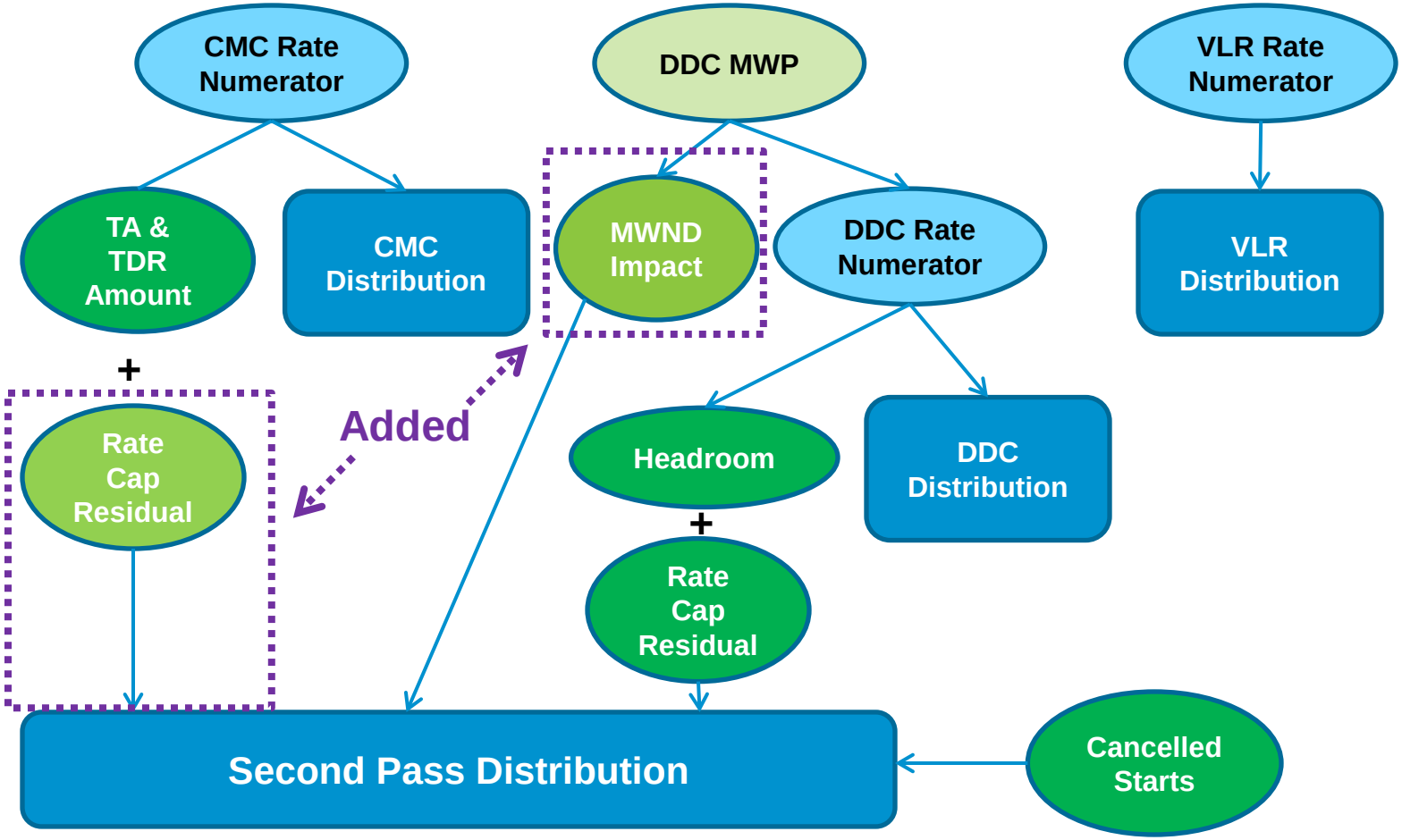
<u>Current</u> RSG Flow Chart



Question 2: RSG Distribution Flow Chart

Once the funds are determined, dollars will be distributed in the following manner:

<u>Proposed</u> RSG Flow Chart



Please see the Appendix for a numerical example of this calculation under the proposed rate methodology

Session 2:

Constraint Management Charge

Question 3: CMC vs. Schedule 46 language consistency

- RT RSG CMC Charge definition in section 1.537a refers to the final result of assessing the RT RSG CMC Rate to the applicable CMC Adjusted Deviation Volume
- Schedule 46 determines the amount of all RT RSG Credits that should be considered in the numerator of the RT RSG CMC Rate
- If additional clarity in Schedule 46 is merited, the following change would be amenable:

  "the share of Real-Time Revenue Sufficiency Guarantee Credits attributable to Resources committed in any RAC processes or the LAC process for Active Transmission Constraints, pursuant to Section 40.3.3.a.v"

- The phrase "and not otherwise attributable to Topology Adjustment and Transmission De-rates" should not be included in the modification because this is not correct.

Question 4: Proposed CMC Formula Change

- The proposed CMC Rate multiplies the hourly economic maximum dispatch by the CMC Allocation Factor
- Upon further reflection and discussion with the IMM, MISO believes that the hourly economic maximum dispatch should be multiplied by BOTH the CMC Allocation Factor and the CCF
- This change ensures the CMC rate cap is calculated on a constraint flow basis consistent with the CMC rate
  - The CMC rate for Adjusted Deviation Volume is in terms of per MW of increased flow on the ATC
  - By multiplying the hourly economic maximum by the CCF in the CMC rate cap, it puts the rate cap in terms of per MW of decreased flow on the ATC
  - MISO will be recommending this change to its proposal.

Question 4: CMC Formula Example

- **Resource: CMC.ABC123**
- Hourly RT RSG MWP = $1000, RT_MAX_DSP = 100, CCF = 0.35

<u>Current</u> CMC ATC Rate Formula:

$$\frac{\text{Hourly RT RSG MWP} \times \text{CCF of Resource Committed}}{\text{MAX [CMC Deviations + TA \& TDR Volume, (RT_MAX_DSP * CCF)]}}$$

No rate cap:

$$\frac{1000 \times 0.35}{\text{MAX [}\mathbf{\mathit{90}}\text{ + 10, (100 * 0.35)]}}$$

Resulting Rate = $3.50

With rate cap:

$$\frac{1000 \times 0.35}{\text{MAX [}\mathbf{\mathit{5}}\text{ + 10, (100 * 0.35)]}}$$

Resulting Rate = $10.00

**For illustrative purposes, the deviation volume was reduced from 90 MW in the first example to 5 MW in the second example.*

Question 4: CMC Formula Example

- **Resource: CMC.ABC123**
- Hourly RT RSG MWP = $1000, RT_MAX_DSP = 100
- **CMC Allocation Factor = 70%, CCF = .60 or 60%**

<u>Proposed</u> CMC ATC Rate Formula:

$$\frac{\text{Hourly RT RSG MWP} \times \textbf{\textit{CMC Allocation Factor}}}{\text{MAX [CMC Deviations + TA \& TDR Volume, (RT_MAX_DSP * } \textbf{\textit{CMC Allocation Factor * CCF}} \text{)]}}$$

No rate cap:

$$\frac{1000 \times 0.70}{\text{MAX [}\textbf{\textit{90}} + 10, (100 * 0.70 * .60)]}$$

Resulting Rate = $7.00

With rate cap:

$$\frac{1000 \times 0.70}{\text{MAX [}\textbf{\textit{5}} + 10, (100 * 0.70 * .60)]}$$

Resulting Rate = $16.67

**For illustrative purposes, the deviation volume was reduced from 90 MW in the first example to 5 MW in the second example.*

Question 4: CMC Formula Example

- **Impact of using the CMC Allocation Factor rather than the CCF**
  - When the rate cap does not apply
    - If the CMC Allocation Factor is greater than the CCF, it results in a larger CMC ATC Rate.
    - If the CMC Allocation Factor is less than the CCF, it results in a smaller CMC ATC Rate
  - When the rate cap applies
    - The CMC Rate will be greater under the proposed design since CCF has been removed from the numerator.
    - However, when putting the CMC Rate in terms of per MW of Resource capacity, it is the same as it was under the current design
    - $16.67 * .60 = $10, which is the same as the rate cap for the CMC Rate under the current design

Question 5: CMC Allocation Factor vs. CCF

- The application of the CMC Allocation Factor in the numerator of the RT RSG CMC Rate are the result of the IMM's 2011 State of the Market Report Recommendation:
  - *"the share of costs appropriately allocated to the DDC should be limited to a share that reflects MISO's estimate of the typical capacity benefit of these [ATC] commitments*"
  - *This amount is equal to 1 – CMC Allocation Factor.*
- However, MISO must use the CCF to determine the effects of deviations at various network locations on flows over the ATC.
  - The direction (helping or hurting) and magnitude of a deviation's effect on an ATC can only be calculated using a CCF.
  - Without the CCF, one cannot even distinguish whether a deviation at a location is helping or hurting the constraint.
  - The CCF must also be used to calculate flow effects of the resource committed to manage the ATC.

Question 6: Impact of Changes on CMC Rate

- Utilizing the CMC Allocation Factor instead of the CCF to adjust the numerator of the RT RSG CMC Rate will generally increase the RT RSG CMC Rate.
  - The IMM estimated that the average CCF of Resources committed for ATC was 35 percent.
  - We estimate that the CMC Allocation factor is > 90 percent.
  - Replacing 35 percent with 90 percent in the numerator of the CMC rate increases the rate by 2.5 times.
- The RT RSG CMC Charge will also increase
- This outcome addresses the IMM's conclusion in the 2011 State of the Market Report
  - *"the CMC formula currently under-allocates congestion-related RSG costs to the deviations that contribute to the need to incur these costs"*

Session 3:

Day-Ahead Schedule Deviation and Headroom Charge

Question 7: Load Zones with Net Injections

- A deviation that results from a load zone with a net injection has two potential effects:
  - It normally provides additional capacity in real time and is, therefore, a “helping” deviation from a capacity perspective; and
  - It may cause deviations on transmission constraints that may be helping or hurting depending on the CCF.
- These effects are independent and are, therefore, independently captured in the following charges:
  - **Constraint Management Charge**
    - A Load Zone with net injection can cause the incurrence of real-time CMC costs if it increases the flow on a constraint, causing the need to commit a Resource to manage the constraint
  - **Day-Ahead Deviation Charge and Headroom Charge**
    - Although it is normally “helping”, if the amount of expected net injection decreases from the NDL, that decrease can cause the need to commit a Resource for economic capacity

Question 8: Post-NDL Load Deviation calculation

- The CMC Post-Notification Deadline Load Deviation calculation is completed in three steps
  - Section 40.3.3.a.iii(4) calculates the “raw” deviation

    “Raw” Post-NDL Load Zone Deviation = Real-Time Load Zone Demand Forecast – (IF Actual Energy Withdrawal > 0 THEN AEW ELSE AEI)
  - Section 40.3.3.a.iv applies the CCF to the “raw” deviation which becomes the “Adjusted Deviation”

    Post-NDL Load Zone Adjusted Deviation = “Raw” Post-NDL Load Zone Deviation × CCF
  - Section 40.3.3.a.iv(b) defines which Adjusted Deviations will be charged the RT RSG CMC Rate

    MAX(Post-NDL Load Zone Adjusted Deviation , 0)
- The DDC Post-Notification Deadline Load Deviation calculation is completed in section 40.3.3.a.viii(6)

  MAX((IF Actual Energy Withdrawal > 0 THEN AEW ELSE AEI) - Real-Time Load Zone Demand Forecast, 0)

Question 9: Day-Ahead Deviation and Headroom Credit example

- **The Day-Ahead Deviation and Headroom Credit (DDHC) is the amount of RT RSG MWP which should be collected using the RT RSG Day-Ahead Deviation and Headroom Charge Rate**
  - DDHC is the numerator of the DDC Rate calculation

- **DDHC is determined based on 3 scenarios**
  - Market-wide Net Deviations + Headroom Need >= Economically Committed Capacity
  - Market-wide Net Deviations + Headroom Need <= 0
  - Economically Committed Capacity > Market-wide Net Deviations + Headroom Need >= 0

Question 9: Day-Ahead Deviation and Headroom Credit example

- **The following terms are used to determine the DDHC**

  Market-wide Net Deviations: Is the aggregate of all Day-Ahead Schedule Deviations, pre-Notification Deadline and Post-Notification Deadline.

  = Σ DDC Deviations

  Headroom Need: Equal to the greater of: (1) Unloaded Capacity Requirement and (2) sixty percent of hourly Load Change.

  = MAX (Unloaded Capacity Requirement, 60% × hourly Load change)

  Economically Committed Capacity: Is equal to the sum of (i) available capacity (RT_MAX_DSP) for all capacity Resource commitments (ii) the amount of available capacity for all ATC Resource Commitments not otherwise considered in the CMC Rate, and (iii) the amount of available capacity for all VLR Resource Commitments not otherwise considered in the VLR Charge.

  = $RT_MAX_DSP_{CAP}$ – ($RT_MAX_DSP_{CMC}$ × CMC Allocation Factor) – ($RT_MAX_DSP_{VLR}$ × VLR Allocation Ratio)

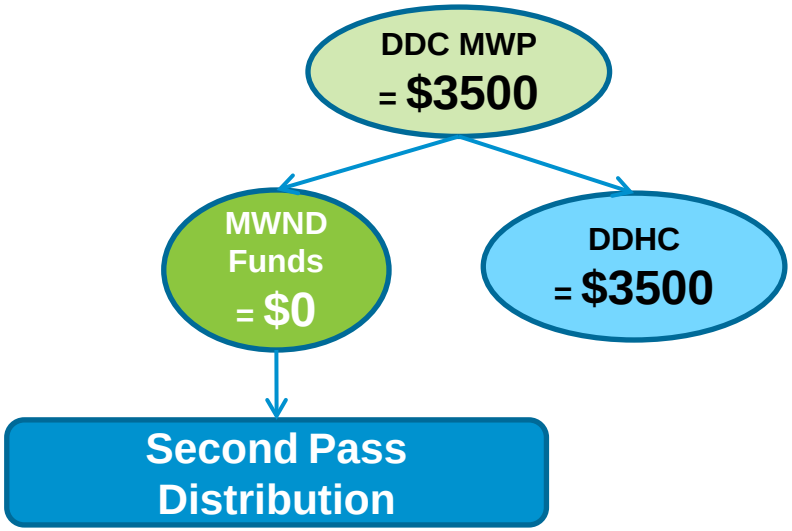
Question 9: Day-Ahead Deviation and Headroom Credit example

- **Scenario 1: Equal or Greater**

Market-wide Net Deviations + Headroom Need >= Economically Committed Capacity

Determinant	Volume
Market-Wide Net Deviations	2000 MW
Headroom Need	750 MW
Economically Committed Capacity	1000 MW

2000 MW + 750 MW >= 1000 MW



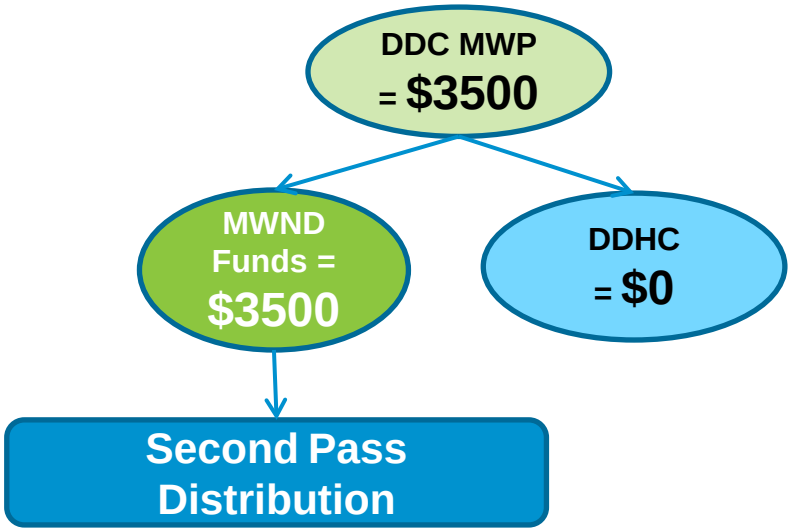
Question 9: Day-Ahead Deviation and Headroom Credit example

- **Scenario 2: Negative or Zero**

Market-wide Net Deviations + Headroom Need <= 0

Determinant	Volume
Market-Wide Net Deviations	-800 MW
Headroom Need	750 MW
Economically Committed Capacity	1000 MW

-800 MW + 750 MW <= 0 MW



Question 9: Day-Ahead Deviation and Headroom Credit example

- **Scenario 3 uses an additional term:**

  Real-Time Revenue Sufficiency Guarantee Market-Wide Net Rate: This is the quotient of:

  (1) aggregate residual Real-Time RSG Credit amount not funded through: (i) the Constraint Management Charge, including any residual not funded through the Real-Time RSG Constraint Management Rate (ii) Voltage and Local Reliability Charge or (iii) otherwise not attributable to Topology Adjustment and Transmission De-rate and

  (2) the Economically Committed Capacity

  = (RT RSG MWP – CMC Distribution – CMC Rate Cap Residual – VLR Distribution – TA & TDR Amount) / Economically Committed Capacity

  <u>OR</u> **= { RT RSG MWP_{CAP} + [RT RSG MWP_{CMC} × (1 - CMC Allocation Factor)] + [RT RSG MWP_{VLR} × (1 – VLR Allocation Ratio)] } / Economically Committed Capacity**

Question 9: Day-Ahead Deviation and Headroom Credit example

- **In the filing on August 7, 2013 the Real-Time Revenue Sufficiency Guarantee Market-wide Net Rate ("RSG Net Rate") was applied to Market-wide Net Deviations to determine the numerator of the DDC Rate**

  = Market-Wide Net Deviations × RSG Net Rate

- **The RSG Net Rate should have been applied to the sum of Market-wide Net Deviations and Headroom Need**

  = (Market-Wide Net Deviations + Headroom) × RSG Net Rate

- **If the sum of Market-wide Net Deviations and Headroom Need is negative a negative DDHC amount would be passed to the numerator of the DDC Rate**

Question 9: Day-Ahead Deviation and Headroom Credit example

- **To correct the possibility of a negative DDHC amount, MISO is proposing the following change to Section 40.3.3.a.ix of the MISO Tariff:**

  "If the sum of (i) the Market-Wide Net Deviations; and (ii) Headroom Need is greater than zero, but less than the Economic Committed Capacity, the Day-Ahead Schedule Deviation and Headroom Credit is equal to the product of: (i) the sum of (a) the Market-Wide Net Deviations and (b) Headroom Need; and(ii) the Real-Time Revenue Sufficiency Guarantee Market-Wide Net Rate."

- **This change will cause the DDHC to reflect only the portion of the capacity commitments that could have been caused by the deviations.**

Question 9: Day-Ahead Deviation and Headroom Credit example

- **Scenario 3: Positive and Less**

Economically Committed Capacity > Market-wide Net Deviations + Headroom Need >= 0

Determinant	Volume
Market-Wide Net Deviations	-100 MW
Headroom Need	750 MW
Economically Committed Capacity	1000 MW

1000 MW > -100 MW + 750 MW >= 0 MW

RSG Net Rate:

$$\frac{\text{DDC MWP}}{\text{Economically Committed Capacity}} = \frac{\$3500}{1000\text{ MW}} = \mathbf{\$3.50}$$

DDHC with proposed change:

RSG Net Rate × (Market-wide Net Deviations + Headroom Need) =

$3.50 × (-100 + 750) = $3.50 × 650 = **$2275**

DDHC:

RSG Net Rate × Market-wide Net Deviations =

$3.50 × -100 = **- $350**

Question 9: Day-Ahead Deviation and Headroom Credit example

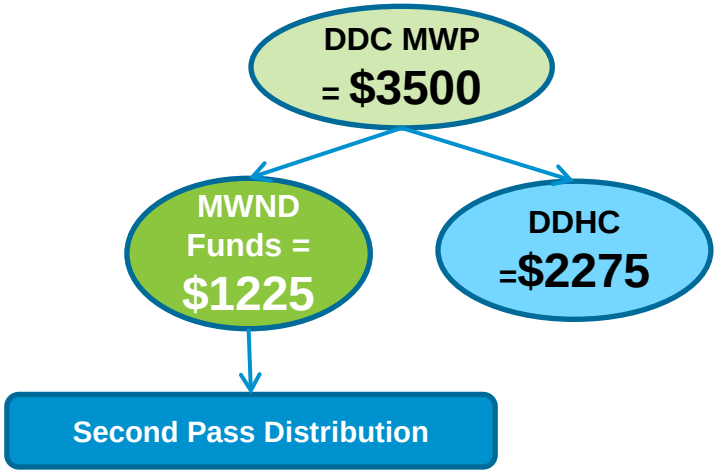
- **Scenario 3: Positive and Less**

Economically Committed Capacity > Market-wide Net Deviations + Headroom Need >= 0

Determinant	Volume
Market-Wide Net Deviations	-100 MW
Headroom Need	750 MW
Economically Committed Capacity	1000 MW

1000 MW > -100 MW + 750 MW >= 0 MW

With proposed change:



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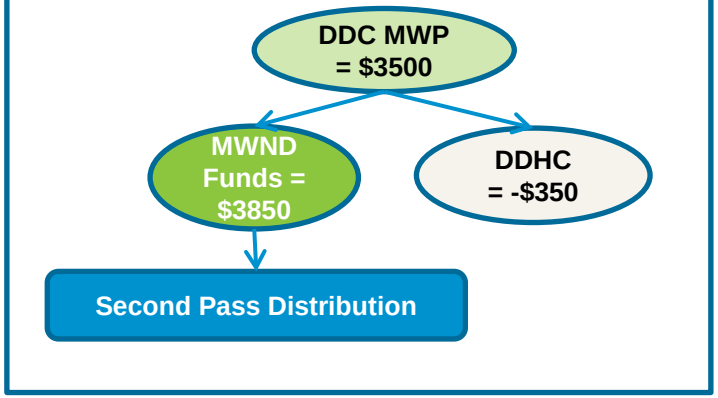


Question 10: Supply-increasing Deviations

- Impact of post-NDL supply decreasing deviations on real-time RSG costs
  - A decrease in the need to commit additional generation (direct effect)
  - A decrease in the Real-Time LMP (secondary effect)
- MISO study of 2012 data
  - On average 1,750 MW of post-NDL supply increasing deviations
  - The study to determine the impact these MWs have on real-time RSG costs is very complex and MISO was not able to perform that study in advance of the Technical Conference
- Impact of LAC on post-NDL supply increasing deviations
  - With the implementation of the LAC, MISO is relying more heavily on the LAC to commit resources closer to the operating hour.
  - Many of the post-NDL deviations that increase supply are known at the time that LAC runs to they tend to reduce commitments by LAC that may otherwise generate RT RSG payments.
  - Hence, with the LAC in operation, post-NDL supply increasing deviations are more likely to avoid real-time commitments and RSG.

Appendix

- **Session 1: Schedule 46**

  Q1: Schedule 46 numerical example

  Q2: RSG Distribution numerical example

Question 1: Schedule 46 Process example

The following example shows the process for calculating the CMC Allocation Factor in Schedule 46. The example uses 2 ATC commitments and calculates the CMC Allocation Factor for the hours of those 2 commitments.

- **Resource: CMC.RES_1**
- Commitment Start = 6/1/2013 10:00; Commitment Stop = 6/1/2013 13:00
- Total RT RSG MWP = $3000; Hourly RT RSG MWP = $3000/3 = $1000
- RT_ECON_MAX = 100 (for all hours)

- **Resource: CMC.RES_2**
- Commitment Start = 6/1/2013 10:00; Commitment Stop = 6/1/2013 11:00
- Total RT RSG MWP = $500; Hourly RT RSG MWP = $500/1 = $500
- RT_ECON_MAX = 50

Question 1: Schedule 46 Process example

- **Step 1**
  - Both Resource Commitments are for ATCs
  - Resource CMC Real-Time RSG MWP (CMC_RES_MWP) = Hourly RT RSG MWP

Resource	Hour	CMC_RES_MWP
CMC.RES_1	10	$1000
CMC.RES_1	11	$1000
CMC.RES_1	12	$1000
CMC.RES_2	10	$500

  - CMC capacity committed ($CMC_CAP_COM_h$) = Σ_{TP} Real-Time Hourly Economic Maximum Limit (RT_ECON_MAX)

Hour	CMC.RES_1	CMC.RES_2	$CMC_CAP_COM_h$
10	100	50	150
11	100	0	100
12	100	0	100

Question 1: Schedule 46 Process example

- **Step 2**

  Resource Headroom (RES_HR) is calculated for all resources in the MISO footprint. Below is a sample calculation for only 1 dispatch interval, assume all intervals were equal for a given hour.

  – **Resource 1:**

    BP = 40, RES_LP_VOL = 40, RT_ECON_MAX = 90, REG_MW = 0, SPIN_MW = 5, SUPP_MW = 0

  – **Resource 2:**

    BP = 35, RES_LP_VOL = 35, RT_ECON_MAX = 50, REG_MW = 5, SPIN_MW = 5, SUPP_MW = 5

RES_HR formula	Resource 1	Resource 2
IF BP >0 AND RES_LP_VOL >0	**TRUE**	**TRUE**
THEN MAX [RT_ECO_MAX – (BP+REG_MW+SPIN_MW+SUPP_MW), 0]	MAX [90 – (40+0+5+0), 0] = MAX(45, 0) = **45**	MAX [50 – (35+5+5+5), 0] = MAX(0, 0) = **0**
RES_HR =	**45**	**0**

Question 1: Schedule 46 Process example

- **Step 2**
  - What does "***Basepoint > 0 AND RES_LP_VOL > 0***" mean?
    - The Resource is online and being dispatched for Energy in a given Dispatch Interval.
  - What does "***MAX [RT_ECO_MAX – (BP + REG_MW + SPIN_MW + SUPP_MW), 0]***" mean?
    - The amount of capacity that is available from the Resource, but not otherwise being used for Energy or Operating Reserves.

Question 1: Schedule 46 Process example

- **Step 2**

  Operations Headroom Need (HR_NEED) is calculated each hour in an evaluation period. The example will demonstrate the calculation for 3 hours.

  – HR_NEED = MAX{Unloaded Capacity Requirement, MAX [60% × MAX($\Sigma_{TP_Next_Hour}$ MAX($RT_BLL_MTR_{GEN}$ +NAI, 0) - $\Sigma_{TP+Current_Hour}$ MAX($RT_BLL_MTR_{GEN}$ +NAI, 0),0)] }

	Hour 10	Hour 11	Hour 12
Unloaded Capacity Requirement	750	750	750
Next Hour $RT_BLL_MTR_{GEN}$ +NAI	44000	44300	43800
Current Hour $RT_BLL_MTR_{GEN}$ +NAI	42500	44000	44300
MAX (60% * Load Change)	900	180	0
HR_NEED	900	750	750

Question 1: Schedule 46 Process example

- **Step 2**
  - What is "***HR_NEED***"?
    - MISO RT Operations has observed that when we have less than 750 MW of Headroom during flat load periods or when we have less than 60% of observed load change in any hour, it results in scarcity prices which are not indicative of actual system conditions
    - In other words, the Headroom Need represents the amount of on-line available capacity, not otherwise being used for Energy and Operating Reserves, necessary in order to ensure reliable and efficient operations

Question 1: Schedule 46 Process example

- **Step 2**

  Capacity MW Needed (CAP_MW_NEED) is calculated for all hours of the evaluation period. The example will demonstrate the calculation for 3 hours.

  CAP_MW_NEED = HR_AVAIL – HR_NEED – CMC_CAP_COM

  IF CAP_MW_NEED > 0, **THEN** CAP_COM_NEED = 0, **ELSE** CAP_COM_NEED = 1

	Hour 10	Hour 11	Hour 12
HR_AVAIL*	1000	800	1000
HR_NEED	900	750	750
CMC_CAP_COM	150	100	100
CAP_MW_NEED	-50	-50	150
CAP_COM_NEED	1	1	0

* HR_AVAIL is the sum of HR_RES for all Resources. HR_RES was only calculated for 1 hour, for only 2 Resources. There would be multiple Resources on and available for each hour, therefore we will assume a HR_AVAIL value to calculate CAP_MW_NEED.

Question 1: Schedule 46 Process example

- **Step 2**
  - What is "***CAP_MW_NEED***"?
    - It identifies the remaining amount of total Headroom Available (HR_AVAIL), after taking into account the amount of capacity needed for the Headroom Need (HR_NEED) and the amount of capacity associated with Resources committed for ATCs (CMC_CAP_COM)

Question 1: Schedule 46 Process example

- **Step 4**

  CAP_COM_NEED has been established for each Hour, therefore the Capacity Resource Commitment Analysis Period (CAP_RES_COM_AP) can be considered.

Resource	Hour	CMC RES MWP	CAP COM NEED
CMC.RES_1	10	$1000	1
CMC.RES_1	11	$1000	1
CMC.RES_1	12	$1000	0
CMC.RES_2	10	$500	1

- **For CMC.RES_1 the CAP_RES_COM_AP is 6/1/2013 10:00 to 6/1/2013 12:00**
  - The original commitment was from 6/1/2013 10:00 to = 6/1/2013 13:00
  - The commitment duration is limited to those hours with a CAP_COM_NEED

- **For CMC.RES_2 the CAP_RES_COM_AP is 6/1/2013 10:00 to 6/1/2013 11:00**
  - The original commitment was from 6/1/2013 10:00 to 6/1/2012 11:00

Question 1: Schedule 46 Process example

- **Step 4: Replacement Resource Criteria**
  - Ensures that the replacement resource is available for commitment and not otherwise committed
  - Has adequate capacity to meet the need
  - Must not have a requirement to run for longer than is needed
  - Must be able to run for at least as long as is needed
  - Must be able to startup in time to meet the need

Question 1: Schedule 46 Process example

- **Step 4**

  There are 3 replacement Resources available. All 3 were offered as economically available and do not have a commitment during the Operating Day.

  – **Resource: RR.RES_1**

  RT_ECON_MAX = 75, Minimum Run Time = 1 hour, Maximum Run Time = 10 hours, Notification Time + Startup Time = 1 hour, RT_ECON_MIN = 30, Cold Start Up Cost = $500, No Load Cost (All hours) = $50, Incremental Energy Cost (All Hours) = $20

  – **Resource: RR.RES_2**

  RT_ECON_MAX = 75,Minimum Run Time = 1 hour, Maximum Run Time = 10 hours, Notification Time + Startup Time = 1 hour, RT_ECON_MIN = 20, Cold Start Up Cost = $50, No Load Cost (All hours) = $40, Incremental Energy Cost (All Hours) = $50

  – **Resource: RR.RES_3**

  RT_ECON_MAX = 75, ***Minimum Run Time = 3 hours,*** Maximum Run Time = 10 hours, Notification Time + Startup Time = 1 hour, RT_ECON_MIN = 20, Cold Start Up Cost = $300, No Load Cost (All hours) = $45, Incremental Energy Cost (All Hours) = $45

Question 1: Schedule 46 Process example

- **Step 4**

  After evaluating the Resources, there are 2 possible replacement Resources which could replace either CMC Resource: **Resource: RR.RES_1** and **Resource: RR.RES_2**

  $CAP_COM_COST_{CAP_RES_COM_AP}$ = Cold Start Up Cost + $\Sigma_{CAP_RES_COM_AP}$ (No Load Cost + $\Sigma_{0\ to\ CAP_MIN}$ Incremental Energy Cost)

  $CAP_COM_COST_{MW} = CAP_COM_COST_{CAP_RES_COM_AP} / \Sigma_{CAP_RES_COM_AP}$ RT_ECO_MAX

Replacing CMC.RES_1	RR.RES_1	RR.RES_2
$CAP_COM_COST_{CAP_RES_COM_AP}$	=500+(10+600+10+600) = $**1720**	=50+(40+1000+40+1000) **= $2130**
$CAP_COM_COST_{MW}$	=1720/150 = **$11.46**	=2130/150 = **$14.20**

Replacing CMC.RES_2	RR.RES_1	RR.RES_2
$CAP_COM_COST_{CAP_RES_COM_AP}$	=500+(10+600) = $**1110**	=50+(40+1000) **= $1090**
$CAP_COM_COST_{MW}$	=1110/75 = **$14.80**	=1090/75 = **$14.53**

Question 1: Schedule 46 Process example

- **Step 4**

  The Capacity Commitment MWP (CAP_COM_MWP) is calculated using the least cost replacement Resource.

$$CAP_COM_MWP = MAX\ [CAP_COM_COST - \Sigma_{CAP_RES_COM_AP}\ (CAP_MIN \times RT_LMP),\ 0]$$

Resource	Hour	CMC_RES_MWP	CAP_COM_NEED	CMC_RR	CAP COM MWP
CMC.RES_1	10	$1000	1	RR.RES_1	= 1720 – [(30 * 20) + (30 * 20)] = 520/2 = **$260**
CMC.RES_1	11	$1000	1	RR.RES_1	= 1720 – [(30 * 20) + (30 * 20)] = 520/2 = **$260**
CMC.RES_1	12	$1000	0	N/A	
CMC.RES_2	10	$500	1	RR.RES_2	= 1090 – (20 * 20) = **$690**

*A RT_LMP of $20 was assumed for both replacement Resources.

Question 1: Schedule 46 Process example

- **Step 4**

  Specific logic calculates the Capacity Contribution (CAP_CON) and CMC Contribution (CMC_CON) for each Hour. A third Resource was added to show a case when no replacement Resource is found and there is a Capacity Need.

  If CAP_COM_NEED = 0 **Then** CMC_CON = CMC_RES_MWP

  Else If CAP_COM_NEED = 1 **AND** CMC_RR NOT EXIST **Then** CAP_CON = CMC_RES_MWP

  Else CAP_CON = MIN(CMC_RES_MWP, CAP_COM_MWP) **AND** CMC_CON = MAX(CMC_RES_MWP – CAP_COM_MWP, 0)

Resource	Hour	CMC RES MWP	CAP COM NEED	CAP COM MWP	CAP_CON	CMC_CON
CMC.RES_1	10	$1000	1	$260	$260	$740
CMC.RES_1	11	$1000	1	$260	$260	$740
CMC.RES_1	12	$1000	0		$0	$1000
CMC.RES_2	10	$500	1	$690	$500	$0
CMC.NO_RR	13	$50	1	No replacement	$50	$0

Question 1: Schedule 46 Process example

- **Step 4**

  The Final Step in calculating the CMC Allocation Factor is to divide the CMC_CON total by the Sum of the CAP_CON total and CMC_CON totals for the study period.

  CMC Allocation Factor = CMC_CON / (CAP_CON + CMC_CON)

  CMC Allocation Factor = $1070 / (1070 + 2480) = 70%

Resource	Hour	CMC RES MWP	CAP COM NEED	CAP COM MWP	CAP_CON	CMC_CON
CMC.COM_1	10	$1000	1	$260	$260	$740
CMC.COM_1	11	$1000	1	$260	$260	$740
CMC.COM_1	12	$1000	0		$0	$1000
CMC.COM_2	10	$500	1	$690	$500	$0
CMC.NO_RR	13	$50	1	No replacement	$50	$0
Sum					$1070	$2480

Question 2: RSG Distribution Flow Chart

The following example will show the allocation of RT RSG MWP dollars paid to three Resources, committed for different Reasons (CMC, VLR and Capacity)

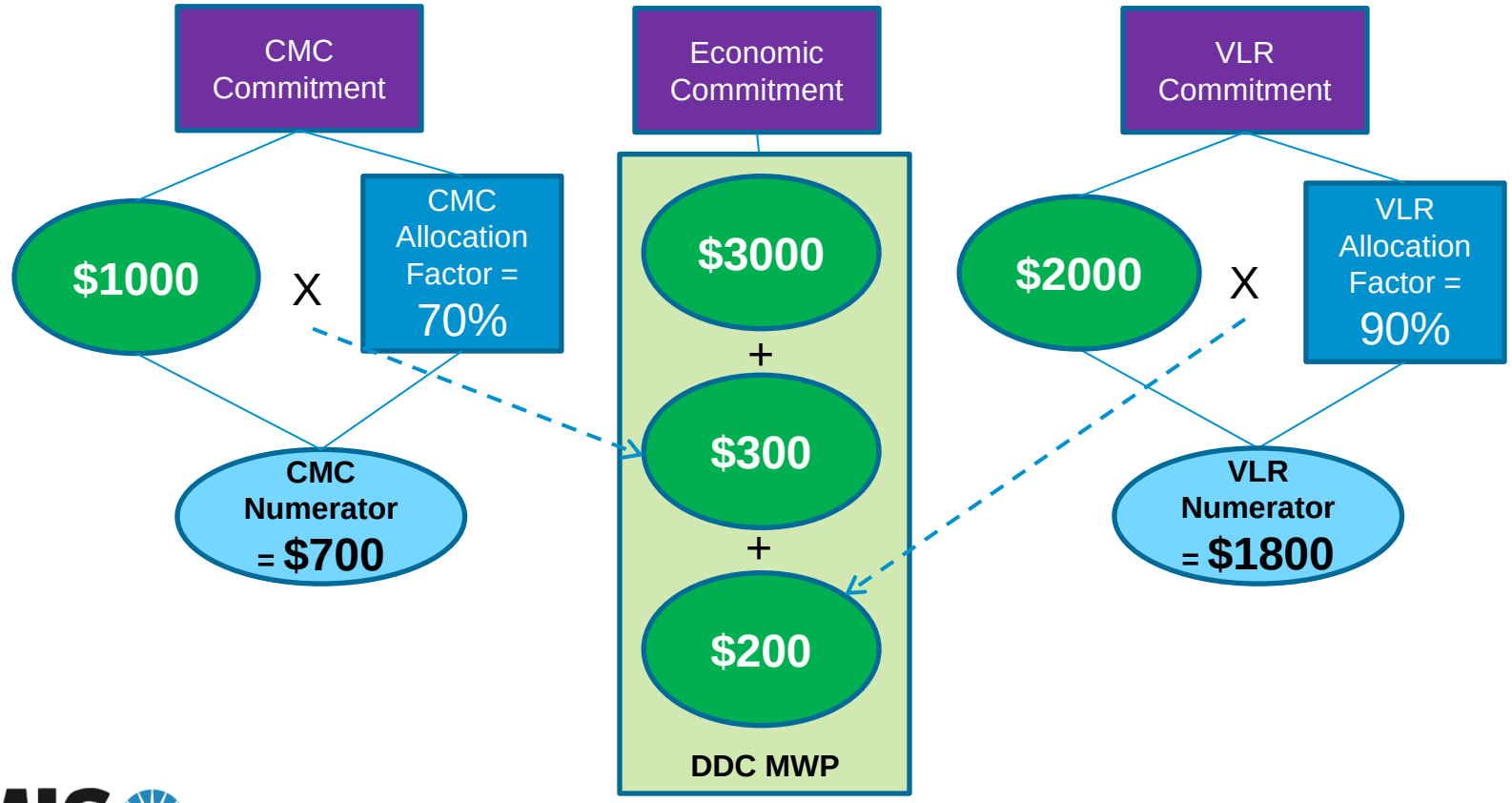
– The following assumptions have been made:
  - CMC Allocation Factor = 70%
  - Resource Constraint Contribution Factor (CCF) = 1 or 100%
  - VLR Allocation Ratio = 90%
  - CMC Deviations = 10 MW
  - DDC Deviations = 3400 MW
  - Topology Adjustments and Transmission De-rate Volume = 2 MW
  - Headroom = 100 MW

Resources	Commitment Type	RT_MAX_DSP	RT RSG MWP
CMC.RES_1	CMC	50	$1000
VLR.RES_2	VLR	20	$2000
CAP.RES_3	Capacity	100	$3000

Question 2: RSG Distribution Flow Chart

Resource commitments are classified as CMC, Economic, or VLR

<u>Proposed</u> RSG Flow Chart



Question 2: RSG Distribution Flow Chart

Proposed CMC ATC Rate Formula:

$$\frac{\text{Hourly RT RSG MWP} \times \text{CMC Allocation Factor}}{\text{MAX [CMC Deviations + TA \& TDR Volume, (RT_MAX_DSP * CMC Allocation Factor * CCF)]}} = \frac{1000 \times 70\%}{\text{MAX [10 + 2, (50 } \times 70\% * 100\%)]}$$

Proposed CMC ATC Rate Formula:

$$\frac{\text{Hourly RT RSG MWP} \times \text{CMC Allocation Factor}}{\text{MAX [CMC Deviations + TA \& TDR Volume, (RT_MAX_DSP * CMC Allocation Factor * CCF)]}} = \frac{700}{\text{MAX [12, 35]}}$$

Proposed CMC ATC Rate Formula:

$$\frac{\text{Hourly RT RSG MWP} \times \text{CMC Allocation Factor}}{\text{MAX [CMC Deviations + TA \& TDR Volume, (RT_MAX_DSP * CMC Allocation Factor * CCF)]}} = \frac{700}{35} = \textbf{\textit{\$20.00}}$$

Question 2: RSG Distribution Flow Chart

CMC Distribution:

CMC Deviations × CMC ATC Rate = 10 MW × $20.00 = $200

Topology Adjustment and Transmission De-rate Amount:

TA and TDR Volume × CMC ATC Rate = 2 MW × $20.00 = $40

Rate Cap Residual Amount:

CMC Numerator – (CMC Distribution + TA & TDR Amount) = $700 – ($200 + $40) = $460

Question 2: RSG Distribution Flow Chart

Proposed DDC Rate Formula:

$$\frac{\text{DDC_CREDIT}}{\text{MAX (DDC Deviations + Headroom, Economically Committed Capacity)}} = \frac{3000 + 300 + 200}{\text{MAX } \{ 3400 + 100, [100 - (50 \times 70\%) - (20 * 90\%) \}}$$

Proposed DDC Rate Formula:

$$\frac{\text{DDC_CREDIT}}{\text{MAX (DDC Deviations + Headroom, (Economically Committed Capacity)}} = \frac{3500}{\text{MAX } \{ 3500, 47 \}}$$

Proposed DDC Rate Formula:

$$\frac{\text{DDC_CREDIT}}{\text{MAX (DDC Deviations + Headroom, (Economically Committed Capacity)}} = \frac{3500}{3500} = \textbf{\textit{\$1.00}}$$

Question 2: RSG Distribution Flow Chart

DDC Distribution:

DDC Deviations × DDC Rate = 3400 MW × $1.00 = $3400

Headroom Amount:

Headroom × DDC Rate = 100 MW × $1.00 = $100

Rate Cap Residual Amount:

DDC Numerator – (DDC Distribution + Headroom Amount) = $3500 – ($3400 + $100) = $0

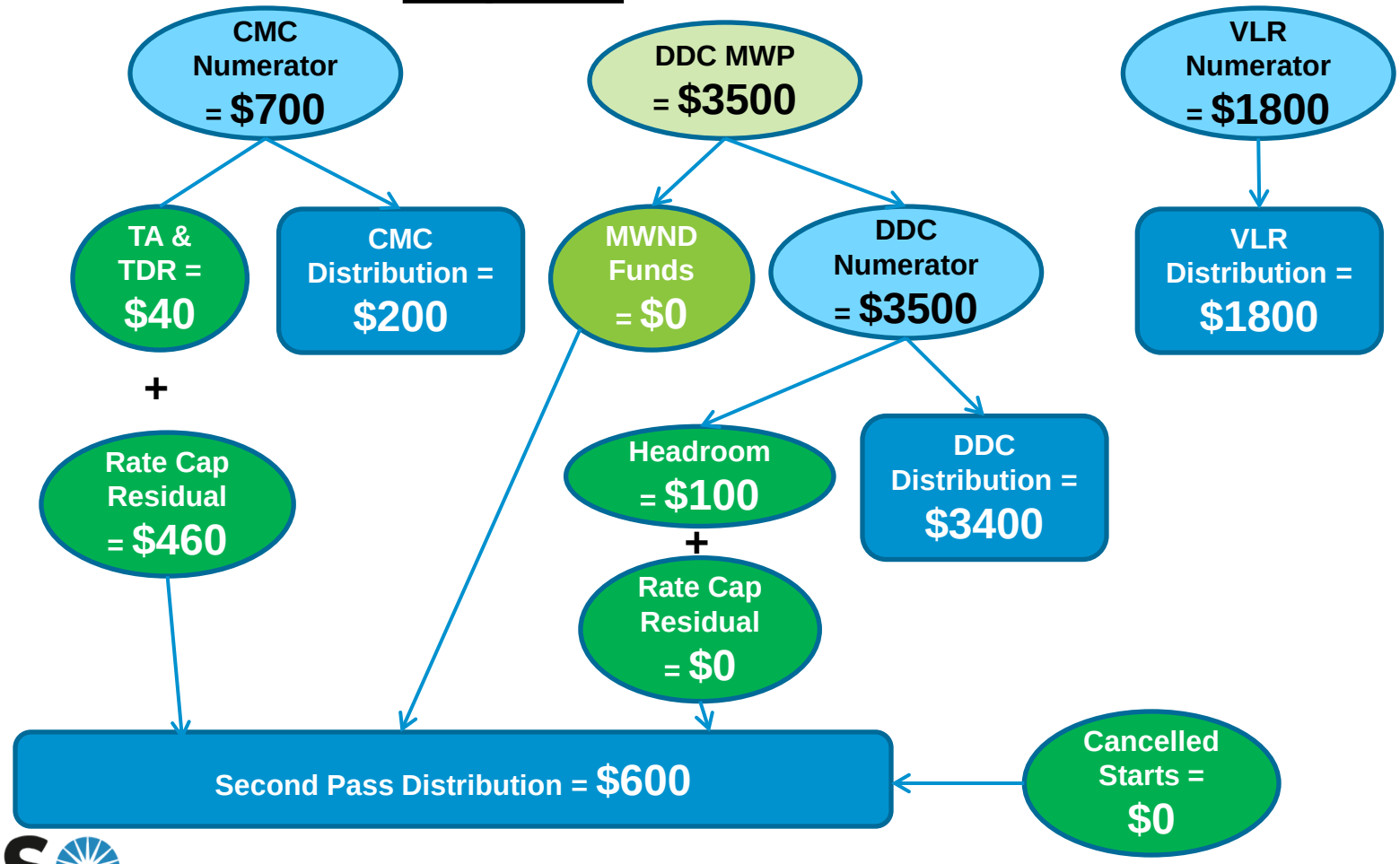
Question 2: RSG Distribution Flow Chart

VLR Distribution Amount:

VLR Distribution = $1800

* VLR is wholly collected within the VLR Bucket

Question 2: RSG Distribution Flow Chart

Once the funds are determined, dollars will be distributed in the following manner:

<u>Proposed</u> RSG Flow Chart