DECEMBER 14, 2022

Market Renewal Program: Market Settlements

Additional Examples (Part 3 of 3)

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Webinar Participation

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Meeting Purpose and Agenda

Purpose: Prepare stakeholders for their review of the proposed market rules and market manuals that codify the Market Settlements detailed designs

Agenda:

- Brief overview of conforming changes to Market Entry obligations and procedures
- Overview of structure and content of the proposed market rules and market manuals for Settlements and Billing
- Review basic examples of settlement amounts

Approach

- Market settlements is by nature very calculations-heavy
- To assist in understanding, the IESO has prepared a number of examples for stakeholder review
- To further aid synthesis of the rules, or to aid broader understanding of Market Renewal, stakeholders are encouraged to ask for additional scenarios and examples

Engagement Timeline

December 1: Materials posted for stakeholder review

December 14: Introduction and discussion with participants

Throughout December and January: Stakeholders can request additional examples or scenarios through engagement@ieso.ca

Mid-January: Segmented discussions with stakeholders to review examples/scenarios

February 21: Comments/feedback on market rules and market manuals due to IESO

Segmented Stakeholder Discussions

The IESO will host stakeholder meetings in mid-January for market participants to review the base-case(s) and answer any additional participant questions relating to settlement

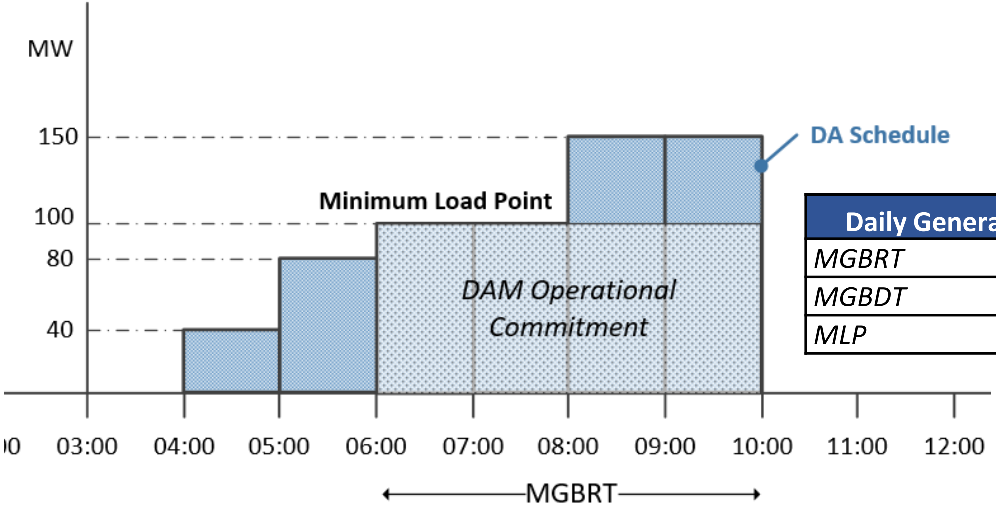
Meetings dates/times are posted on the Market Renewal Implementation webpage for stakeholder sign-up: https://www.ieso.ca/en/Market-Renewal/Stakeholder-Engagements/Implementation-Engagement-Market-Rules-and-Market-Manuals

Market Settlement Batch:
Additional Examples

Additional Examples:
Day-Ahead Market Generator Offer Guarantee (DAM GOG)

DAM_GOG – Scenario 2

- Resource is scheduled in the day-ahead market from HE5 to HE10 with day-ahead operational commitment from HE7 to HE10
- Resource is scheduled out of merit in hour HE9 and HE10



Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW

DAM Price and Schedule		
HE	DA_LMP ($)	DA_QSI (MW)
5	35	40
6	35	80
7	35	100
8	35	100
9	35	150
10	35	150

❖ Resource has <u>no</u> OR schedule

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DAM_GOG – Scenario 2

- The energy offers are the same for all of the scheduled hours

DAM Energy Offers (DAM_BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (DAM_BE_SU)
10,000

SNL Offer $ (DAM_BE_SNL)
800

- Resource received DAM_MWP for HE9 and HE 10 for following dispatch

DAM_MWP	
HE	DAM_MWP ($)
9	250
10	250

- Resource injects in real-time and achieves MLP at the first interval of the day-ahead operational commitment

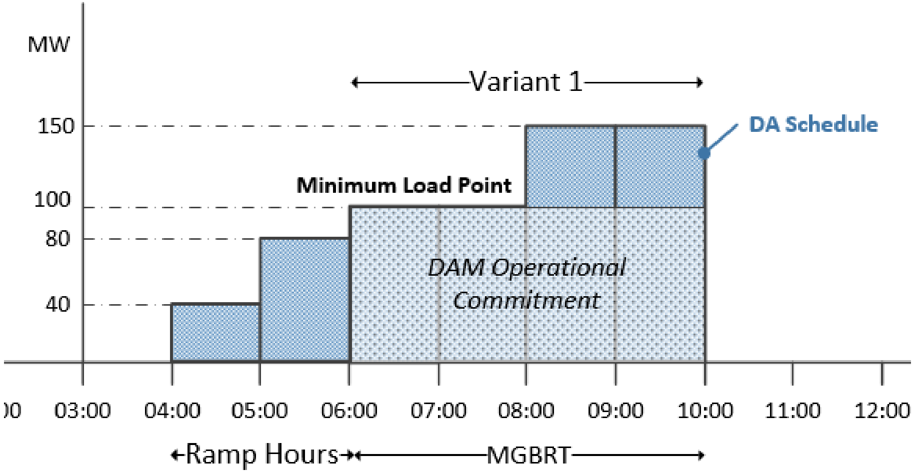
RT Hourly Schedule and Injection		
HE	RT_QSI (MW)	AQEI (MW)
5	40	40
6	80	80
7	100	100
8	100	100
9	150	150
10	150	150

**Assumption: resource is scheduled and injecting at the day-ahead position in all of the scheduled hours*

DAM_GOG Calculation – Scenario 2

Step 1: Determine the commitment period, variant number and ramp hours for GOG calculation

HE	Period Definition	Variant #
5	Ramp-up period	
6	Ramp-up period	
7	Day-ahead commitment period	1
8	Day-ahead commitment period	1
9	Day-ahead commitment period	1
10	Day-ahead commitment period	1



DAM_GOG for Variant 1 = Max(0, COMP1 + COMP2 + COMP4 - COMP5)

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DAM_GOG Calculation – Scenario 2

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

- 1 x OP(DAM Energy)		
HE	**-1 x OP(DAM_LMP,DAM_QSI,DAM_BE)**	**Result**
5		
6		
7	-1 x (35$/MWh x 100MW - 35$/MWh x 100MW) =	**0**
8	-1 x (35$/MWh x 100MW - 35$/MWh x 100MW) =	**0**
9	-1 x (35$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**250**
10	-1 x (35$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**250**

- *The operating profit for energy will be calculated for each hour of the commitment period from HE7 to HE10, excluding the ramp hours*

DAM_GOG Calculation – Scenario 2

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

SNL Cost			
HE	***N - # of Inj Int***	***DAM_BE_SNL x N/12***	**Result**
5			
6			
7	12	800 x 12/12 =	**800**
8	12	800 x 12/12 =	**800**
9	12	800 x 12/12 =	**800**
10	12	800 x 12/12 =	**800**

- *The speed-no-load will be calculated for each hour of the commitment period starting from HE7 to HE10*
- *N is the number of metering intervals in settlement hour that the resource was synchronized and injecting energy into the grid*
- *As resource is injecting for all four hours of the commitment period, **N=12** for all four hours*

DAM_GOG Calculation – Scenario 2

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

- Ramp Revenue		
HE	**- DAM_LMP x DAM_QSI**	**Result**
5	- 35$ x 40 MW =	**-1,400**
6	- 35$ x 80 MW =	**-2,800**
7		
8		
9		
10		

DAM_GOG Calculation – Scenario 2

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue				
HE	***-OP (DAM Energy)***	***SNL Cost***	**-Ramp Revenue**	**COMP1**
5			-1,400	**-1,400**
6			-2,800	**-2,800**
7	0	800		**800**
8	0	800		**800**
9	250	800		**1,050**
10	250	800		**1,050**

DAM_GOG Calculation – Scenario 2

Step 3: Calculation of DAM_GOG Component 4

DAM_GOG_COMP4 = DAM_BE_SU

COMP4 = DAM_BE_SU		
HE	***DAM_BE_SU***	**COMP4**
5		
6		
7	10,000	**10,000**
8		
9		
10		

- *The start-up offer associated with the **first hour (HE7)** of the commitment period is considered in the GOG calculation*
- *As the resource achieves MLP on time at the first interval of the commitment period, the **full** start-up offer is included in the calculation*

DAM_GOG Calculation – Scenario 2

Step 4: Calculation of DAM_GOG Component 5

DAM_GOG_COMP5 = DAM_MWP

COMP5		
HE	***DAM_MWP***	**COMP5**
5		
6		
7		
8		
9	250	**250**
10	250	**250**

DAM_GOG Calculation – Scenario 2

Step 5: Calculation of DAM GOG

DAM_GOG = Max(0, COMP1 + COMP2 + COMP4 - COMP5)					
HE	COMP1	COMP2	COMP4	- COMP5	Total
5	-1,400			0	**-1,400**
6	-2,800			0	**-2,800**
7	800		10,000	0	**10,800**
8	800			0	**800**
9	1,050			-250	**800**
10	1,050			-250	**800**
Total	**-500**	**0**	**10,000**	**-500**	**9,000**
DAM_GOG = Max(0,9000) = $9,000					

❖ *Resource has no OR schedule:* ***COMP2 = 0***

DAM_GOG Calculation – Scenario 2

The DAM_GOG (**$9,000**) is a positive value; hence the following settlement amounts will appear on the settlement statement:

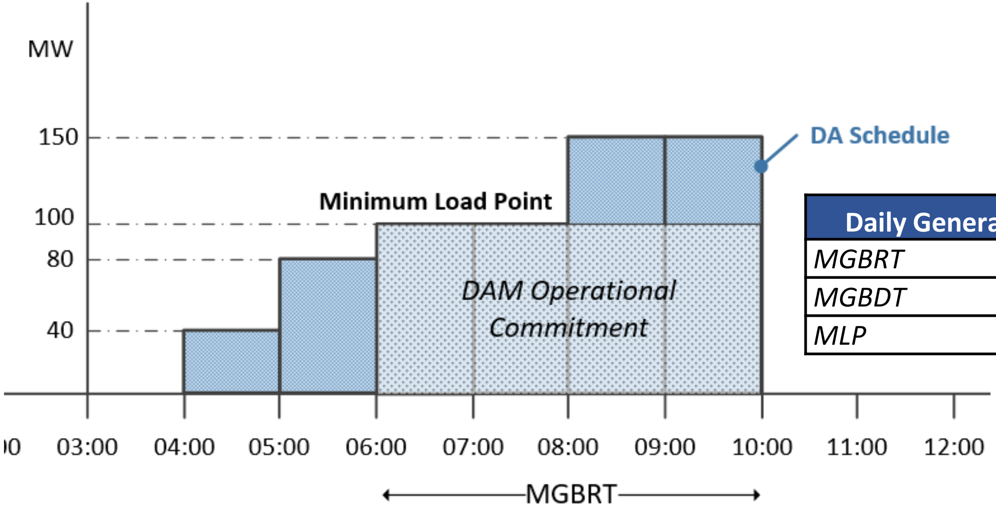
Settlement Amounts on Settlement Statement							
		HE 5	HE 6	HE 7	HE 8	HE 9	HE 10
1804	Day-Ahead Market generator Offer Gurantee - Energy	-$1,400	-$2,800	$800	$800	$1,050	$1,050
1807	Day-Ahead Market generator Offer Gurantee - Start Up			$10,000			
1808	Day-Ahead Market generator Offer Gurantee - DAM Make-Whole Payment Offset					-$250	-$250

DAM_GOG – Scenario 3

DAM_GOG – Scenario 3

- Resource is scheduled in the day-ahead market from HE5 to HE10 with day-ahead operational commitment from HE7 to HE10
- Resource did not reach MLP until HE8 interval 1

DAM Price and Schedule		
HE	DA_LMP ($)	DA_QSI (MW)
5	40	40
6	40	80
7	40	100
8	40	100
9	40	150
10	40	150



Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW

DAM_GOG – Scenario 3

- The energy offers are the same for all of the scheduled hours

DAM Energy Offers (DAM_BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (DAM_BE_SU)
10,000

SNL Offer $ (DAM_BE_SNL)
800

- Resource injects in real-time and achieves MLP at the first interval HE8, 1 hour late for its day-ahead commitment period

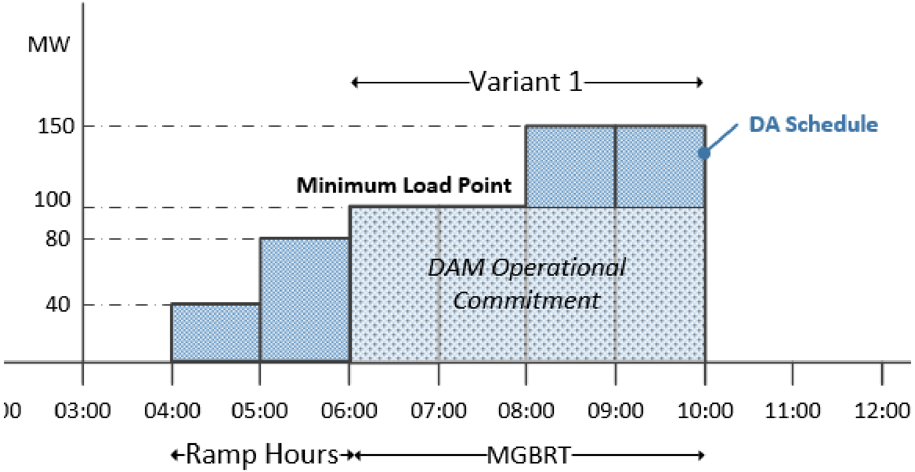
RT Hourly Schedule and Injection		
HE	RT_QSI (MW)	AQEI (MW)
5	40	40
6	80	80
7	80	80
8	100	100
9	150	150
10	150	150

*Resource is scheduled and injecting in real-time at the same level.

DAM_GOG Calculation – Scenario 3

Step 1: Determine the commitment period, variant number and ramp hours for GOG calculation

HE	Period Definition	Variant #
5	Ramp-up period	
6	Ramp-up period	
7	Day-ahead commitment period	1
8	Day-ahead commitment period	1
9	Day-ahead commitment period	1
10	Day-ahead commitment period	1



DAM_GOG for Variant 1 = Max(0, COMP1 + COMP2 + COMP4 - COMP5)

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DAM_GOG Calculation – Scenario 3

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

- 1 x OP(DAM Energy)		
HE	**-1 x OP(DAM_LMP,DAM_QSI,DAM_BE)**	**Result**
5		
6		
7	-1 x (40$/MWh x 100MW - 35$/MWh x 100MW) =	**-500**
8	-1 x (40$/MWh x 100MW - 35$/MWh x 100MW) =	**-500**
9	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**
10	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**

- *The operating profit for energy will be calculated for each hour of the commitment period from HE7 to HE10, excluding the ramp hours*

DAM_GOG Calculation – Scenario 3

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

SNL Cost			
HE	***N - # of Inj Int***	***DAM_BE_SNL x N/12***	**Result**
5			
6			
7	12	800 x 12/12 =	**800**
8	12	800 x 12/12 =	**800**
9	12	800 x 12/12 =	**800**
10	12	800 x 12/12 =	**800**

- *The speed-no-load will be calculated for each hour of the commitment period starting from HE7 to HE10*
- *N is the number of metering intervals in settlement hour that the resource was synchronized and injecting energy into the grid*
- *As resource is injecting for all four hours of the commitment period, **N=12** for all four hours*

DAM_GOG Calculation – Scenario 3

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

- Ramp Revenue		
HE	**- DAM_LMP x DAM_QSI**	**Result**
5	- 40$ x 40 MW =	**-1,600**
6	- 40$ x 80 MW =	**-3,200**
7		
8		
9		
10		

DAM_GOG Calculation – Scenario 3

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

COMP1 = - OP(Energy) + SNL Cost – Ramp Revenue				
HE	***-OP (Energy)***	***SNL Cost***	**-Ramp Revenue**	**COMP1**
5			-1,600	**-1,600**
6			-3,200	**-3,200**
7	-500	800		**300**
8	-500	800		**300**
9	-500	800		**300**
10	-500	800		**300**

DAM_GOG Calculation – Scenario 3

Step 3: Calculation of DAM_GOG Component 4

DAM_GOG_COMP4 = DAM_BE_SU - DAM_BE_SU x N_INT/12

COMP4			
HE	***N_INT***	***DAM_BE_SU – DAM_BE_SU x N_INT /12***	**COMP4**
5			
6			
7	6	10,000 - 10,000 x 6/12 =	**5,000**
8			
9			
10			

- *The start-up offer associated with the **first hour (HE7)** of the commitment period is considered in the GOG calculation*
- *N_INT is the number of metering intervals after the first six metering intervals that the resource took to achieve its MLP*
- *Resource reaches MLP in HE8 interval 1, it took the resource 6 intervals after the first six metering intervals to reach MLP: **N_INT = 6***

DAM_GOG Calculation – Scenario 3

Step 4: Calculation of DAM GOG

DAM_GOG = Max(0, COMP1 + COMP2 + COMP4 - COMP5)					
HE	**COMP1**	**COMP2**	**COMP4**	**- COMP5**	**Total**
5	-1,600				**-1,600**
6	-3,200				**-3,200**
7	300		5,000		**5,300**
8	300				**300**
9	300				**300**
10	300				**300**
Total	**-3,600**	**0**	**5,000**		**1400**
DAM_GOG = Max(0,1400) = $1,400					

- *Resource has no OR schedule:* ***COMP2 = 0***
- *Resource is scheduled economically in all hours of the commitment period, therefore no DAM_MWP is generated:* ***COMP5 = 0***

DAM_GOG Calculation – Scenario 3

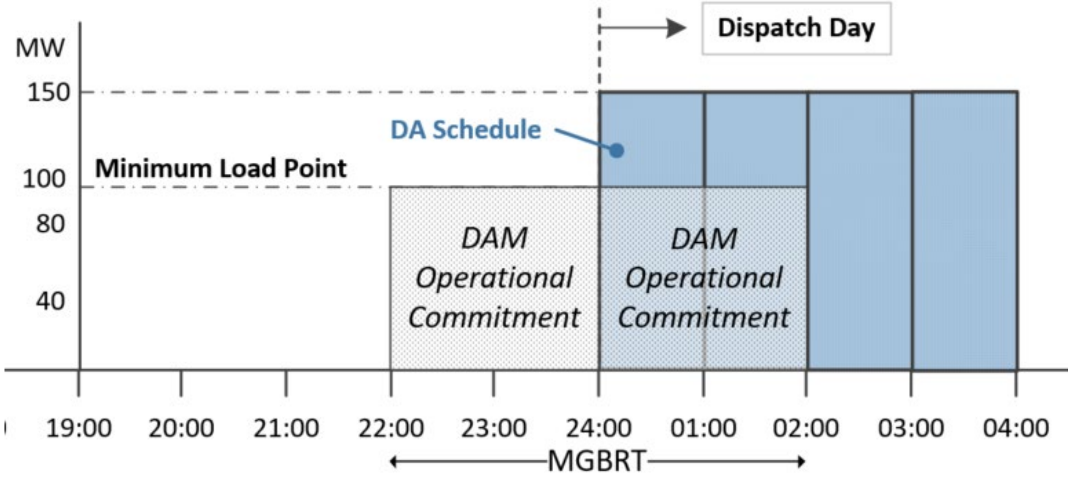
The DAM_GOG (**$1,400**) is a positive value; hence the following settlement amounts will appear on the settlement statement:

Settlement Amounts on Settlement Statement							
		HE 5	HE 6	HE 7	HE 8	HE 9	HE 10
1804	Day-Ahead Market generator Offer Gurantee - Energy	-$1,600	-$3,200	$300	$300	$300	$300
1807	Day-Ahead Market generator Offer Gurantee - Start Up			$5,000			

DAM_GOG – Scenario 4

DAM_GOG – Scenario 4

- Resource is scheduled in HE1 and HE2 of the dispatch day to complete its MGBRT from the previous day
- Resource is scheduled beyond its MGBRT for additional 2 hours from HE3 to HE4



DAM Price and Schedule		
HE	DA_LMP ($)	DA_QSI (MW)
1	40	150
2	40	150
3	40	150
4	40	150

Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW

DAM_GOG – Scenario 4

- The energy offers are the same for all of the scheduled hours

DAM Energy Offers (DAM_BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (DAM_BE_SU)
10,000

SNL Offer $ (DAM_BE_SNL)
800

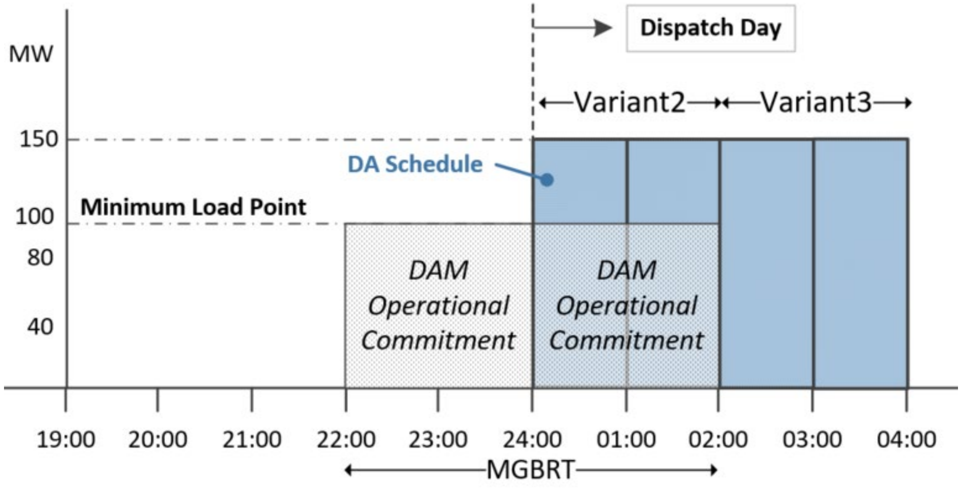
- Resource is scheduled and injecting at the day-ahead position in all of the scheduled hours

RT Hourly Schedule and Injection		
HE	RT_QSI (MW)	AQEI (MW)
1	150	150
2	150	150
3	150	150
4	150	150

DAM_GOG Calculation – Scenario 4

Step 1: Determine the commitment period, variant number and ramp hours for GOG calculation

HE	Period Definition	Variant #
7	Day-ahead commitment period	2
8	Day-ahead commitment period	2
9	Day-ahead commitment period	3
10	Day-ahead commitment period	3



DAM_GOG for Variant 2 = Max(0, COMP1 + COMP2 - COMP3 - COMP5)

DAM_GOG for Variant 3 = Max(0, COMP1 + COMP2 - COMP5)

DAM_GOG Calculation – Scenario 4

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

- 1 x OP(DAM Energy)		
HE	**-1 x OP(DAM_LMP,DAM_QSI,DAM_BE)**	**Result**
1	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**
2	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**
3	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**
4	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**

- *The operating profit for energy will be calculated for each hour of the commitment period from HE1 to HE4*

DAM_GOG Calculation – Scenario 4

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

SNL Cost			
HE	***N - # of Inj Int***	***DAM_BE_SNL x N/12***	**Result**
1	12	800 x 12/12 =	**800**
2	12	800 x 12/12 =	**800**
3	12	800 x 12/12 =	**800**
4	12	800 x 12/12 =	**800**

Ramp Revenue = 0

- *The speed-no-load will be calculated for each hour of the commitment period from HE1 to HE4*
- *N is the number of metering intervals in settlement hour that the resource was synchronized and injecting energy into the grid.*
- *As resource is injecting for all four hours of the commitment period,* ***N=12*** *for all four hours*
- *No ramp period associated with the commitment period, therefore* ***Ramp Revenue = 0***

DAM_GOG Calculation – Scenario 4

Step 2: Calculation of DAM_GOG Component 1

DAM_GOG_COMP1 = - OP(DAM Energy) + SNL Cost – Ramp Revenue

COMP1 = - OP(Energy) + SNL Cost – Ramp Revenue				
HE	***-OP (Energy)***	***SNL Cost***	**-Ramp Revenue**	**COMP1**
1	-500	800		**300**
2	-500	800		**300**
3	-500	800		**300**
4	-500	800		**300**

DAM_GOG Calculation – Scenario 4

Step 3: Calculation of DAM_GOG Component 3

DAM_GOG_COMP3 = -1 x OP(MLP) + SNL Cost

- 1 x OP(DAM Energy)		
HE	**-1 x OP(DAM_LMP,MLP,DAM_BE)**	**Result**
1	-1x(40$/MWh x 100MW - 35$/MWh x 100MW) =	**-500**
2	-1x(40$/MWh x 100MW - 35$/MWh x 100MW) =	**-500**
3		
4		

- *Component 3 applies only the Variant 2 hours*

DAM_GOG Calculation – Scenario 4

Step 3: Calculation of DAM_GOG Component 3

DAM_GOG_COMP3 = -1 x OP(MLP) + SNL Cost

SNL Cost			
HE	*N - # of Inj Int*	*DAM_BE_SNL x N/12*	Result
1	12	800 x 12/12 =	**800**
2	12	800 x 12/12 =	**800**

- *Component 3 applies only the Variant 2 hours*
- *N is the number of metering intervals in settlement hour that the resource was synchronized and injecting energy into the grid*
- *As resource is injecting for both hours of the commitment period, **N=12** for both hours*

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DAM_GOG Calculation – Scenario 4

Step 4: Calculation of DAM GOG

DAM_GOG = Max(0, COMP1 + COMP2 - COMP 3 - COMP5)					
HE	COMP1	COMP2	- COMP3	- COMP5	Total
1	300		- 300		**0**
2	300		- 300		**0**
3	300				**300**
4	300				**300**
Total	**1,200**	**0**	**- 600**	**0**	**600**
DAM_GOG = Max(0,600) = $600					

- *Resource has no OR schedule:* ***COMP2 = 0***
- *Resource is scheduled economically in all hours of the commitment period, therefore no DAM_MWP is generated:* ***COMP5 = 0***

DAM_GOG Calculation – Scenario 4

The DAM_GOG (**$600**) is a positive value; hence the following settlement amounts will appear on the settlement statement:

Settlement Amounts on Settlement Statement					
		HE 1	HE 2	HE 3	HE 4
1804	Day-Ahead Market generator Offer Gurantee - Energy	$300	$300	$300	$300
1806	Day-Ahead Market generator Offer Gurantee - Over Midnight	-$300	-$300		

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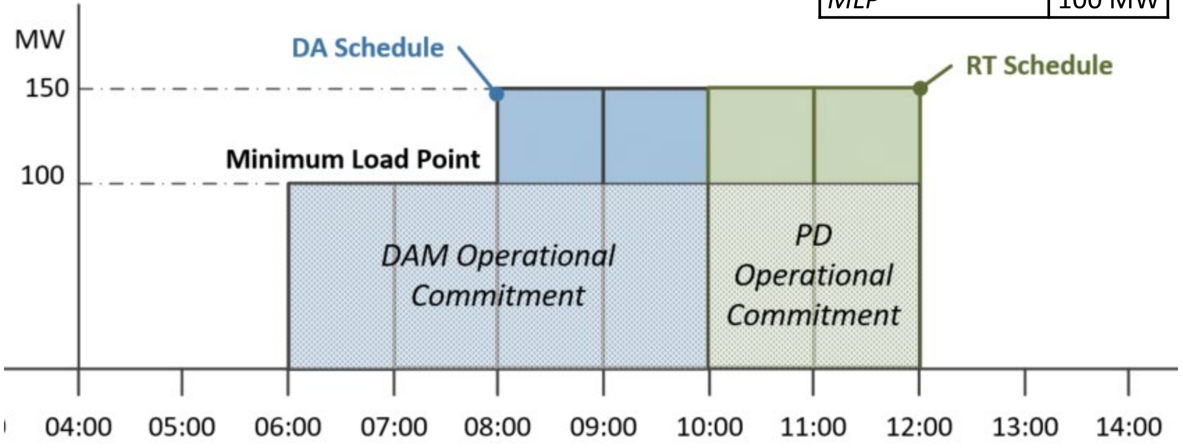
Additional Examples:
Real-Time Generator Offer Guarantee (RT GOG)

RT_GOG – Scenario 2

RT_GOG – Scenario 2

- Resource is committed by the pre-dispatch engine with an operational commitment from **HE11 to HE12**, after a DAM commitment

Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW



RT Price and Schedule		
HE	**RT_LMP ($)**	**RT_QSI (MW)**
7	40	100
8	40	100
9	40	150
10	40	150
11	40	150
12	40	150

DAM Price and Schedule		
HE	**DAM_LMP ($)**	**DAM_QSI (MW)**
7	40	100
8	40	100
9	40	150
10	40	150
11	-	-
12	-	-

RT_GOG – Scenario 2

- The energy offers are the same for all of the scheduled hours

- Resource injects in real-time and achieves MLP at the first interval of the pre-dispatch operational commitment

RT Energy Offers (BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (PD_BE_SU)
10,000

SNL Offer $ (PD_BE_SNL)
800

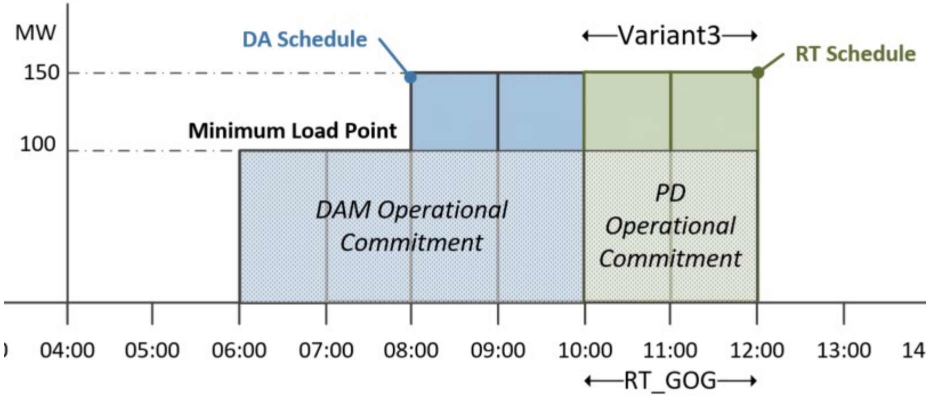
RT Hourly Schedule and Injection		
HE	RT_QSI (MW)	AQEI (MW)
7	100	100
8	100	100
9	150	150
10	150	150
11	150	150
12	150	150

**Assumption: resource is injecting at the real-time scheduled position*

RT_GOG Calculation – Scenario 2

Step 1: Determine the commitment period, variant number and ramp hours for RT_GOG calculation

HE	Period Definition	Variant #
7	-	-
8	-	-
9	-	-
10	-	-
11	Real-time commitment period	3
12	Real-time commitment period	3



RT_GOG for Variant 3 = Max(0, COMP1 + COMP2 - COMP5)

RT_GOG Calculation – Scenario 2

Step 2: Calculation of RT_GOG Component 1

RT_GOG_COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue

- 1 x OP(RT Energy)		
HE	**-1 x Max(OP(RT_LMP,RT_QSI,BE), OP(RT_LMP,AQEI,BE))*** **	**Result**
11	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**
12	-1 x (40$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-500**

****As RT_QSI=AQEI, the operating profit calculation is the same for the two quantities****

SNL Cost			
HE	***N - # of Inj Int***	***PD_BE_SNL x N/12***	**Result**
9	12	800 x 12/12 =	**800**
10	12	800 x 12/12 =	**800**

- *As there are no ramp hours associated with this commitment period, **Ramp Revenue = 0***

RT_GOG Calculation – Scenario 2

Step 2: Calculation of RT_GOG Component 1

RT_GOG_COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue

COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue				
HE	***-OP (RT Energy)***	***SNL Cost***	**-Ramp Revenue**	**COMP1**
11	-500	800		**300**
12	-500	800		**300**

RT_GOG Calculation – Scenario 2

Step 5: Calculation of RT GOG

RT_GOG = Max(0, COMP1 + COMP2 - COMP5)				
HE	**COMP1**	**COMP2**	**- COMP5**	**Total**
11	300			**300**
12	300			**300**
Total	**600**	**0**	**0**	**600**
RT_GOG = Max(0,600) = $600				

Settlement Amounts on Settlement Statement			
		HE 11	HE 12
1910	Real-Time Generator Offer Guarantee - Energy	$300	$300

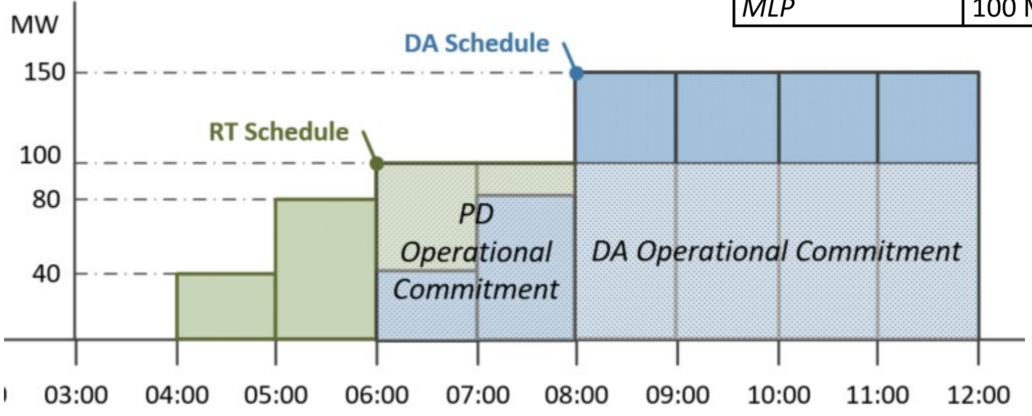
- *Resource has no OR schedule:* ***COMP2 = 0***
- *Resource is scheduled economically in all hours of the commitment period, therefore no RT_MWP is generated:* ***COMP5 = 0***

RT_GOG – Scenario 3

RT_GOG – Scenario 3

- Resource is committed by the pre-dispatch engine with a pre-dispatch operational commitment from **HE7 to HE8** in advance of a DAM commitment starting from HE9

Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW



RT Price and Schedule		
HE	RT_LMP ($)	RT_QSI (MW)
5	40	40
6	40	80
7	40	100
8	40	100
9	40	150
10	40	150
11	40	150
12	40	150

DAM Price and Schedule		
HE	DAM_LMP ($)	DAM_QSI (MW)
7	40	40
8	40	80
9	40	150
10	40	150
11	40	150
12	40	150

RT_GOG – Scenario 3

- The energy are the same for all of the scheduled hours

RT Energy Offers (BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (PD_BE_SU)
12,000

SNL Offer $ (PD_BE_SNL)
800

DAM Energy Offers (DAM_BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (DAM_BE_SU)
10,000

SNL Offer $ (DAM_BE_SNL)
800

- Resource injects in real-time and achieves MLP at the first interval of the pre-dispatch operational commitment

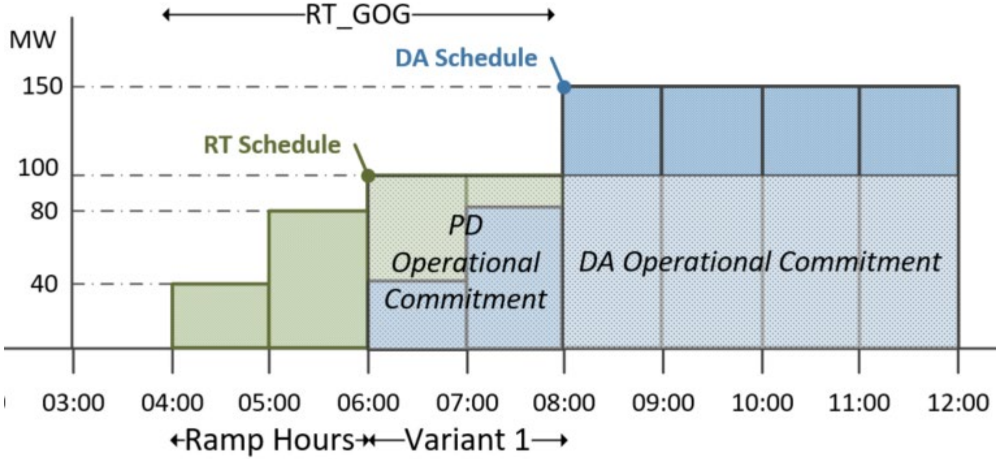
RT Hourly Schedule and Injection		
HE	RT_QSI (MW)	AQEI (MW)
5	40	40
6	80	80
7	100	100
8	100	100
9	150	150
10	150	150
11	150	150
12	150	150

**Assumption: resource is injecting at the real-time scheduled position*

RT_GOG Calculation – Scenario 3

Step 1: Determine the commitment period, variant number and ramp hours for GOG calculation

HE	Period Definition	Variant #
5	Ramp-up period	
6	Ramp-up period	
7	Real-time commitment period	1
8	Real-time commitment period	1
9	-	-
10	-	-
11	-	-
12	-	-



DAM_GOG for Variant 1 = Max(0, COMP1 + COMP2 + COMP4 - COMP5)

RT_GOG Calculation – Scenario 3

Step 2: Calculation of RT_GOG Component 1

RT_GOG_COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue + DAM Revenue

- 1 x OP(RT Energy)		
HE	**-1 x Max(OP(RT_LMP,RT_QSI,BE), OP(RT_LMP,AQEI,BE))*** **	**Result**
5		
6		
7	-1 x (40$/MWh x 100MW - 35$/MWh x 100MW) =	**-500**
8	-1 x (40$/MWh x 100MW - 35$/MWh x 100MW) =	**-500**

****As RT_QSI=AQEI, the operating profit calculation is the same for the two quantities****

- *The operating profit for energy will be calculated for each hour of the commitment period from HE7 to HE8 excluding the ramp hours*

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RT_GOG Calculation – Scenario 3

Step 2: Calculation of RT_GOG Component 1

RT_GOG_COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue

SNL Cost			
HE	***N - # of Inj Int***	***PD_BE_SNL x N/12***	**Result**
5			
6			
7	12	800 x 12/12 =	**800**
8	12	800 x 12/12 =	**800**

- *The speed-no-load will be calculated for each hour of the commitment period starting from HE7 to HE8*
- *N is the number of metering intervals in settlement hour that the resource was synchronized and injecting energy into the grid*
- *As resource is injecting for all four hours of the commitment period,* ***N=12*** *for all two hours*

RT_GOG Calculation – Scenario 3

Step 2: Calculation of RT_GOG Component 1

RT_GOG_COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue + DAM Revenue

- Ramp Revenue		
HE	**- RT_LMP x AQEI**	**Result**
5	- 40$ x 40 MW =	**-1,600**
6	- 40$ x 80 MW =	**-3,200**
7		
8		

+ DAM Revenue		
HE	**+ DAM_LMP x DAM_QSI**	**Result**
5		
6		
7	40$ x 40 MW =	**1,600**
8	40$ x 80 MW =	**3,200**

RT_GOG Calculation – Scenario 3

Step 2: Calculation of RT_GOG Component 1

RT_GOG_COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue + DAM Revenue

COMP1 = - OP(RT Energy) + SNL Cost – Ramp Revenue					
HE	***-OP (RT Energy)***	***SNL Cost***	**-Ramp Revenue**	**DAM Revenue**	**COMP1**
5			-1,600		**-1,600**
6			-3,200		**-3,200**
7	-500	800		1,600	**1,900**
8	-500	800		3,200	**3,500**

RT_GOG Calculation – Scenario 3

Step 4: Calculation of RT_GOG Component 4

RT_GOG_COMP4 = PD_BE_SU – DAM_BE_SU

COMP4 = PD_BE_SU – DAM_BE_SU		
HE	*PD_BE_SU – DAM_BE_SU*	COMP4
5		
6		
7	=12,000 - 10,000	**2,000**
8		
9		
10		

- *The start-up offer associated with the **first hour (HE7)** of the commitment period is considered in the RT_GOG calculation*
- *The resource is committed in advance of a DAM commitment, therefore only the incremental start-up offer above the day-ahead offer is considered*

RT_GOG Calculation – Scenario 3

Step 5: Calculation of RT GOG

RT_GOG = Max(0, COMP1 + COMP2 + COMP4 - COMP5)					
HE	COMP1	COMP2	COMP4	- COMP5	Total
5	-1,600				**-1,600**
6	-3,200				**-3,200**
7	1,900		2,000		**3,900**
8	3,500				**3,500**
Total	**600**		**2,000**	**0**	**2,600**
RT_GOG = Max(0,2600) = $2,600					

- *Resource has no OR schedule:* ***COMP2 = 0***
- *Resource is scheduled economically in all hours of the commitment period, therefore no RT_MWP is generated:* ***COMP5 = 0***

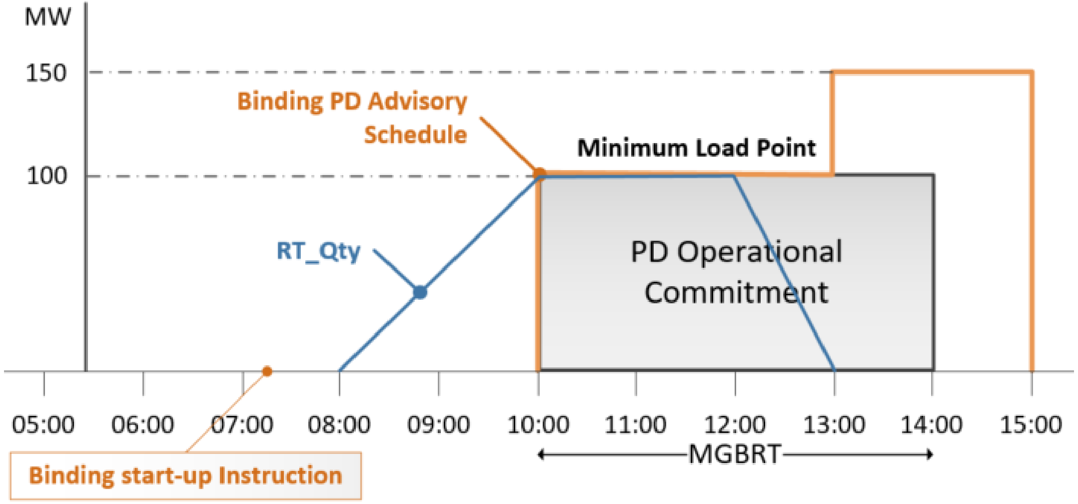
Settlement Amounts on Settlement Statement					
		HE 5	HE 6	HE 7	HE 8
1910	Real-Time Generator Offer Guarantee - Energy	-$1,600	-$3,200	$1,900	$3,500
1913	Real-Time Generator Offer Guarantee - Start Up			$2,000	

Additional Examples:
Generator Failure Charge (GFC)

GFC – Scenario 2

GFC – Scenario 2

- PD engine issues a binding start-up instruction at 7:15 for a commitment from HE11 to HE14
- The resource has a binding PD advisory schedule (issued at 7:15) from HE11 to HE15
- Resource drops below MLP halfway through its MGBRT at HE13 interval 1



RT Price and Schedule		
HE	RT_LMP ($)	RT_QSI (MW)
11	40	100
12	40	100
13	50	50
14	50	0
15	50	0

Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW

GFC – Scenario 2

- The energy offers are the same for all of the scheduled hours
- The binding PD advisory schedule at 7:15 schedules the resource from HE11 to HE15

PD Energy Offers (BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (PD_BE_SU)
5,000

SNL Offer $ (PD_BE_SNL)
900

PD Advisory Price and Schedule		
HE	*PD_LMP@BSUI*	*PD_QSI@BSUI*
11	36	100
12	36	100
13	36	100
14	42	150
15	42	150

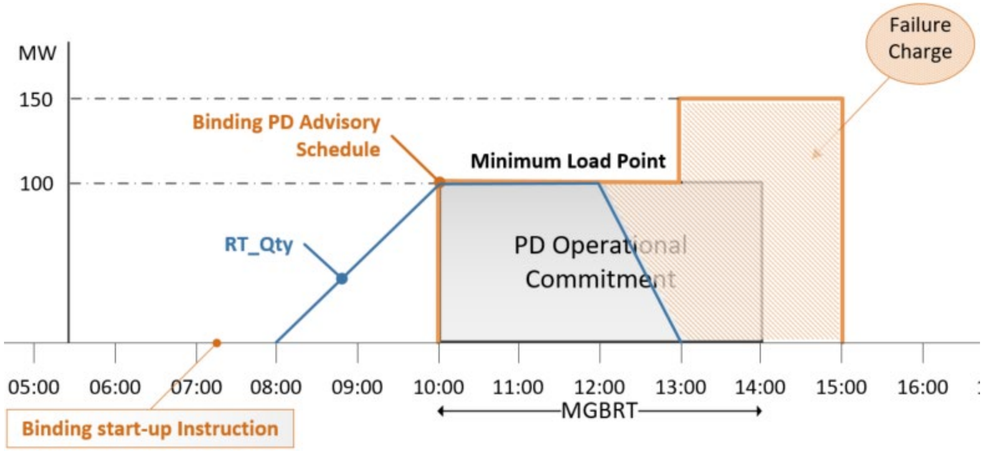
GFC Calculation – Scenario 2

Determine the failure period for GFC calculation

<u>Failure Event:</u> Failing to complete its minimum generation block run-time

<u>Failure Period:</u> From the first metering interval where the GOG-eligible resource has a real-time schedule less than its minimum loading point, until the last metering interval where the GOG-eligible resource has a binding pre-dispatch advisory schedule issued at the time of start-up notice

HE	Period Definition
13	Failure hour (All intervals)
14	Failure hour (All intervals)
15	Failure hour (All intervals)



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GFC_MPC Calculation – Scenario 2

GFC_MPC is calculated as:

GFC_MPC = -1 x (RT_LMP - PD_LMP) x (PD_QSI - AQEI)

GFC_MPC		
HE	**-1 x (RT_LMP - PD_LMP) x (PD_QSI - AQEI)**	**MPC**
13	-1 x (50 - 36) x (100 - 50) =	**-700**
14	-1 x (50 - 42) x (150 - 0) =	**-1,200**
15	-1 x (50 - 42) x (150 - 0) =	**-1,200**

GFC_GCC Calculation – Scenario 2

Step 1: Determine the prorating factor for Start-up Offer - PD_SU_Ratio

PD_SU_Ratio = Min(1,MLP_INJ/MGBRT)

- *MLP_INJ is the number of metering intervals within the MGBRT period that the resource is injecting below MLP*

  MLP_INJ = 12 intervals x 2 hours = 24

- *MGBRT is the number of metering intervals of the minimum generation block run-time*

  MGBRT = 12 intervals x 4 hours = 48

PD_SU_Ratio = Min(1,MLP_INJ/MGBRT) = Min(1,24/48) = 1/2

GFC_GCC Calculation – Scenario 2

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

PD_SU_Ratio x SU_INCR				
HE	***PD_SU_Ratio***	***SU_INCR = PD_BE_SU***	**PD_SU_Ratio x SU_INCR**	***Result***
13	1/2	5,000	= 1/2 x 5,000 =	**2,500**
14				
15				

- *The start-up offer associated with the first hour (HE11) of the commitment period is considered in the GFC_GCC calculation*
- *As HE11 is not part of the failure period, the pro-rated start-up offer is included in the first hour of the failure period in HE13*

GFC_GCC Calculation – Scenario 2

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

SNL Cost			
HE	***N - # of Inj Int***	***PD_BE_SNL x N/12***	**Result**
13	12	900 x 12/12 =	**900**
14	12	900 x 12/12 =	**900**
15	12	900 x 12/12 =	**900**

- *The speed-no-load will be calculated for each hour of the failure period from HE13 to HE15*
- *N is the number of metering intervals in the settlement hour that the resource is within the failure period*
- *As resource failed all hours of the failure period,* ***N=12*** *for all hours*

GFC_GCC Calculation – Scenario 2

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

- 1 x OP(PD_QSI)		
HE	**-1 x OP(PD_LMP,PD_QSI,PD_BE)**	**Result**
13	-1x(36$/MWh x 100MW - 35$/MWh x 100MW) =	**-100**
14	-1x(42$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-800**
15	-1x(42$/MWh x 150MW - 40$/MWh x 50MW - 35$/MWh x 100MW) =	**-800**

GFC_GCC Calculation – Scenario 2

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)				
HE	***PD_SU_Ratio x SU_INCR***	***SNL***	**-OP(PD_QSI)**	**Hourly GCC**
13	2,500	900	-100	**-3,300**
14		900	-800	**-100**
15		900	-800	**-100**
			Total	**-3,500**

GFC_GCC Calculation – Scenario 2

Step 3: Determine the prorating factor for GCC - M1

M1 = 1 - ∑AQEI/∑PD_Qty

Total Quantity of Injection and PD Schedule		
HE	**AQEI**	**PD_QSI**
13	50	100
14	0	150
15	0	150
Total	**50**	**400**

- *The quantity of injection and quantity of PD schedule are summed over the entire failure period for the calculation of M1*

M1 = 1 - ∑AQEI/∑PD_Qty = 1 – 50/400 = 7/8

GFC_GCC Calculation – Scenario 2

Step 4: Determine GCC

GCC = SUM of Hourly GCC x M1 = -3,500 x 7/8 = <u>-3062.5</u>

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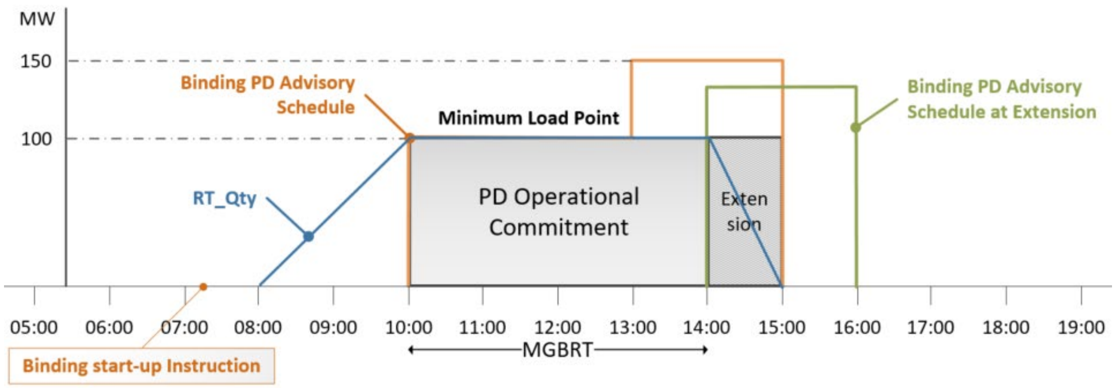
GFC – Scenario 3

GFC – Scenario 3

- PD engine issues a commitment for the resource from HE11 to HE14, and issued an extension for HE15
- Resource has binding PD advisory schedules at binding start-up (issued at 7:15) from HE11 to HE15 and binding PD advisory schedule at extension for HE15 to HE16
- Resource completes its MGBRT but drops below MLP during extension at HE15 interval 1



RT Price and Schedule		
HE	**RT_LMP ($)**	**RT_QSI (MW)**
11	40	100
12	40	100
13	50	100
14	50	100
15	50	50
16	50	0

Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW

GFC – Scenario 3

- The energy offers are the same for all of the scheduled hours

PD Energy Offers (BE)		
PQ #	Price ($/MWh)	Quantity (MW)
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (PD_BE_SU)
5,000

SNL Offer $ (PD_BE_SNL)
900

- The binding PD advisory schedule at 7:15 schedules the resource from HE11 to HE15 and the binding PD advisory schedule at extension schedules the resource for HE15 to HE16

PD Advisory Price and Schedule				
HE	PD_LMP@BSUI	PD_QSI@BSUI	PD_LMP@Ext	PD_QSI@Ext
11	35	100		
12	35	100		
13	35	100		
14	40	150		
15	40	150	42	130
16			42	130

GFC Calculation – Scenario 3

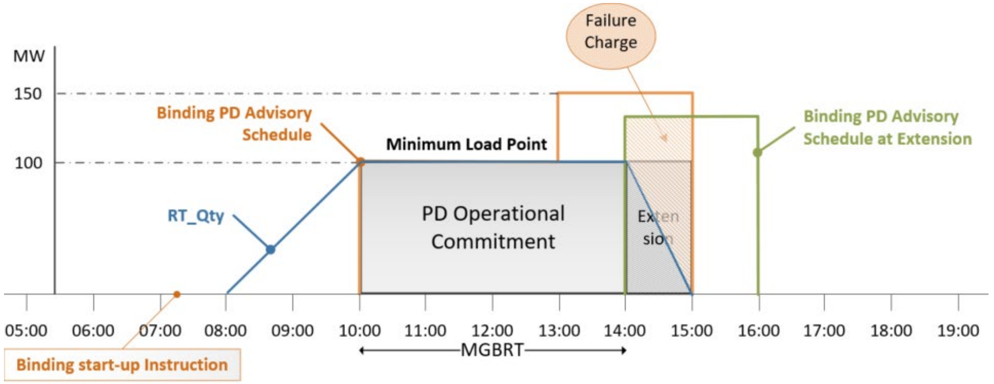
Determine the failure period for GFC calculation

Failure Event: *Failing to complete its extended pre-dispatch operational commitment, where the extension period is still within the binding pre-dispatch advisory schedule*

Failure Period: *From the first metering interval where the GOG-eligible resource has a real-time schedule less than its minimum loading point until the earlier of:*

- *the end of the binding pre-dispatch advisory schedule issued at the time of start-up notice; or*
- *the end of the binding pre-dispatch advisory schedule at the time of extension.*

HE	Period Definition
15	Failure hour (All intervals)



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GFC_MPC Calculation – Scenario 3

GFC_MPC is calculated as:

GFC_MPC = -1 x (RT_LMP - PD_LMP) x (PD_QSI - AQEI)

GFC_MPC		
HE	**-1 x (RT_LMP - PD_LMP) x (PD_QSI - AQEI)**	**MPC**
15	-1 x (50 - 42) x (130 - 50) =	**-640**

GFC_GCC Calculation – Scenario 3

Step 1: Determine the prorating factor for Start-up Offer - PD_SU_Ratio

- *As the pre-dispatch operational commitment violated by the generator failure is an extended pre-dispatch operational commitment, then*

PD_SU_Ratio = 0

SU_INCR = 0

GFC_GCC Calculation – Scenario 3

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

SNL Cost			
HE	***N - # of Inj Int***	***PD_BE_SNL x N/12***	**Result**
15	12	900 x 12/12 =	**900**

- *The speed-no-load will be calculated for each hour of the failure period for HE15*
- *N is the number of metering intervals in settlement hour that the resource within the failure period*
- *As resource failed all intervals of the failure hour,* ***N=12***

- 1 x OP(PD_QSI)		
HE	**-1 x OP(PD_LMP,PD_QSI,PD_BE)**	**Result**
15	-1x(42$/MWh x 130MW - 40$/MWh x 30MW - 35$/MWh x 100MW) =	**-760**

GFC_GCC Calculation – Scenario 3

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)				
HE	***PD_SU_Ratio x SU_INCR***	***SNL***	**-OP(PD_QSI)**	**Hourly GCC**
15		900	-760	**-140**
			Total	**-140**

GFC_GCC Calculation – Scenario 3

Step 3: Determine the prorating factor for GCC - M1

$M1 = 1 - \sum AQEI / \sum PD\_Qty$

Total Quantity of Injection and PD Schedule		
HE	**AQEI**	**PD_QSI**
15	50	130
Total	**50**	**130**

- *The quantity of injection and quantity of PD schedule are summed over the entire failure period for the calculation of M1*

$M1 = 1 - \sum AQEI / \sum PD\_Qty = 1 - 50/130 = 8/13$

Step 4: Determine GCC

GCC = SUM of Hourly GCC x M1 = -140 x 8/13 = <u>-86.15</u>

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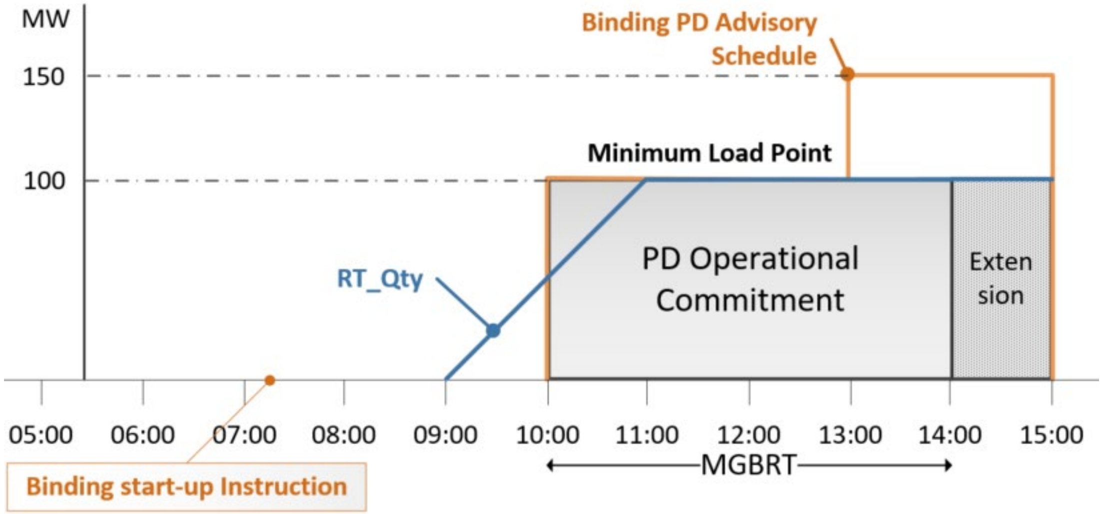
GFC – Scenario 4

GFC – Scenario 4

- PD engine issues a binding start-up instruction at 7:15 for a commitment from HE11 to HE14
- The resource has binding PD advisory schedule at 7:15 from HE11 to HE15
- Resource achieves MLP late after the start of its commitment period at HE12 interval 1



RT Price and Schedule		
HE	RT_LMP ($)	RT_QSI (MW)
11	45	75
12	40	100
13	50	100
14	50	100
15	50	100

Daily Generation Data	
MGBRT	4 hrs
MGBDT	2 hrs
MLP	100 MW

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GFC – Scenario 4

- The energy offers are the same for all of the scheduled hours
- The binding PD advisory schedule at 7:15 schedules the resource from HE11 to HE15

PD Energy Offers (BE)		
PQ #	**Price ($/MWh)**	**Quantity (MW)**
1	35	0
2	35	100
3	40	200
4	50	300

Start-Up Offer $ (PD_BE_SU)
5,000

SNL Offer $ (PD_BE_SNL)
900

PD Advisory Price and Schedule		
HE	***PD_LMP@BSUI***	***PD_QSI@BSUI***
11	36	100
12	36	100
13	36	100
14	40	150
15	40	150

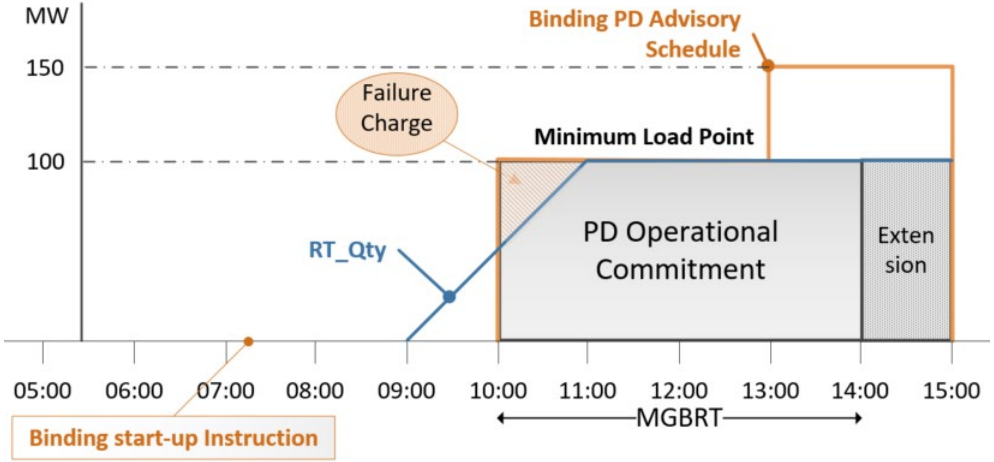
GFC Calculation – Scenario 4

Determine the failure period for GFC calculation

<u>Failure Event:</u> Failing to reach minimum loading point by the first hour of the pre-dispatch operational commitment

<u>Failure Period:</u> From the first metering interval where a GOG-eligible resource has a pre-dispatch operational commitment, until the last metering interval where the GOG-eligible resource has a real-time schedule less than its minimum loading point

HE	Period Definition
11	Failure hour (All intervals)



GFC_MPC Calculation – Scenario 4

GFC_MPC is calculated as:

GFC_MPC = -1 x (RT_LMP - PD_LMP) x (PD_QSI - AQEI)

GFC_MPC		
HE	**-1 x (RT_LMP - PD_LMP) x (PD_QSI - AQEI)**	**MPC**
11	-1 x (45 - 36) x (100 - 75) =	**-225**

GFC_GCC Calculation – Scenario 4

Step 1: Determine the prorating factor for Start-up Offer - PD_SU_Ratio

PD_SU_Ratio = Min(1,MLP_INJ/MGBRT)

- *MLP_INJ is the number of metering intervals within the MGBRT period that the resource is injecting below MLP*

  MLP_INJ = 12 intervals x 1 hour = 12

- *MGBRT is the number of metering intervals of the minimum generation block run-time*

  MGBRT = 12 intervals x 4 hours = 48

PD_SU_Ratio = Min(1,MLP_INJ/MGBRT) = Min(1,12/48) = 1/4

GFC_GCC Calculation – Scenario 4

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

PD_SU_Ratio x SU_INCR				
HE	***PD_SU_Ratio***	***SU_INCR = PD_BE_SU***	**PD_SU_Ratio x SU_INCR**	***Result***
11	1/4	5,000	= 1/4 x 5,000 =	**1,250**

- *The start-up offer associated with the first hour (**HE11**) of the commitment period is considered in the GFC_GCC calculation*

GFC_GCC Calculation – Scenario 4

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

SNL Cost			
HE	***N - # of Inj Int***	***PD_BE_SNL x N/12***	**Result**
11	12	900 x 12/12 =	**900**

- *The speed-no-load will be calculated for the failure period for HE11*
- *N is the number of metering intervals in settlement hour that the resource within the failure period*
- *As resource failed for all intervals of the failure period, **N=12***

- 1 x OP(PD_QSI)		
HE	**-1 x OP(PD_LMP,PD_QSI,PD_BE)**	**Result**
11	-1x(36$/MWh x 100MW - 35$/MWh x 100MW) =	**-100**

GFC_GCC Calculation – Scenario 4

Step 2: Determine the GCC for each hour

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)

GFC_GCC = -1 x (PD_SU_Ratio x SU_INCR+ SNL - OP(PD_QSI)				
HE	***PD_SU_Ratio x SU_INCR***	***SNL***	**-OP(PD_QSI)**	**Hourly GCC**
11	1,250	900	-100	**-2,050**
			Total	**-2,050**

GFC_GCC Calculation – Scenario 4

Step 3: Determine the prorating factor for GCC - M1

M1 = 1 - ∑AQEI/∑PD_Qty

Total Quantity of Injection and PD Schedule		
HE	**AQEI**	**PD_QSI**
11	75	100
Total	**75**	**100**

- *The quantity of injection and quantity of PD schedule are summed over the entire failure period for the calculation of M1*

M1 = 1 - ∑AQEI/∑PD_Qty = 1 – 75/100 = 1/4

Step 4: Determine GCC

GCC = SUM of Hourly GCC x M1 = -2,050 x 1/4 = -512.5

Additional Examples:
Real-Time Make-Whole Payment(RT-MWP)

RT_MWP – Scenario 3

Scenario 2: Load is uneconomically scheduled for energy above it’s EOP

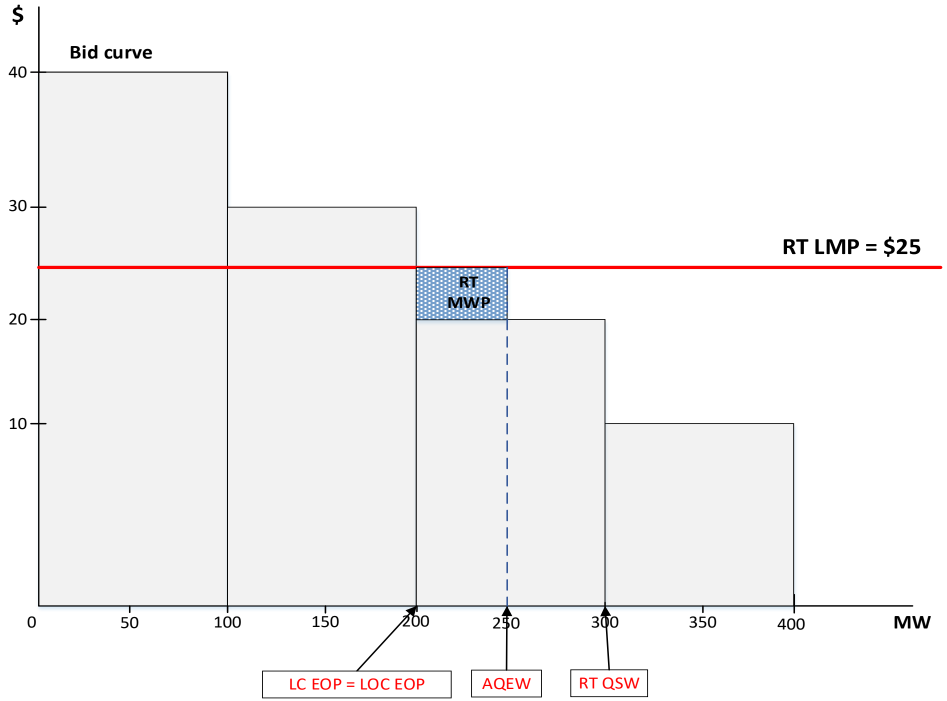
Energy Bids – Dispatch Data		
PQ #	Price ($/MWh)	Quantity (MW)
1	40	0
2	40	100
3	30	200
4	20	300
5	10	400

Schedules, EOP, AQEI	
Type	Quantity (MW)
RT QSI	300 MW
AQEI	250 MW
LC EOP	200 MW
LOC EOP	200 MW
DAM_QSW	0 MW

RT Prices	$
RT LMP	$25

$$RT\_MWP = \sum^{T} Max(0, RT\_ELC + RT\_OLC) + Max(0, RT\_ELOC + RT\_OLOC)$$

RT_MWP – Scenario 3



RT Lost Cost Calculation		
	OP (Min(RT_QSW, AQEW))	OP (RT_LC_EOP)
Revenue	250MW X $25 =	200MW X $25 =
	$6,250	$5,000
Costs	100MW X $40 + 100MW X $30 + 50MW X $20 =	100MW X $40 + 100MW X $30 =
	$8,000	$7,000
Total	$6250 - $8000 =	$5000 - $7000 =
	-$1,750	-$2,000
RT_ELC	Max(0, -$1750 + $2000) = $250	

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RT_MWP – Scenario 3

RT Lost Opportunity Cost Calculation		
	OP (RT_LOC_EOP)	OP (Max(RT_QSW, AQEW))
Revenue	200MW X $25 =	250MW X $25 =
	$5,000	$6,250
Costs	100MW X $40 + 100MW X $30 =	100MW X $40 + 100MW X $30 + 50MW X $20 =
	$7,000	$8,000
Total	$5000 - $7000 =	Max(0, $6250 - $8000) =
	-$2,000	$0.00
RT_ELOC	-1*($-2000 - $0) = $2000	

Conclusion:
Since LOC_EOP < RT_QSI, resource is not eligible for RT _ELOC

RT_MWP = Max(0, $250) + 0 = $250

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RT_MWP – Scenario 4

Scenario 4: A generator is activated for operating reserve in RT

Step 1 : Calculate lost cost for energy

Energy Offers – Dispatch Data		
PQ #	Price ($/MWh)	Quantity (MW)
1	10	0
2	10	100
3	20	200
4	30	300
5	40	400

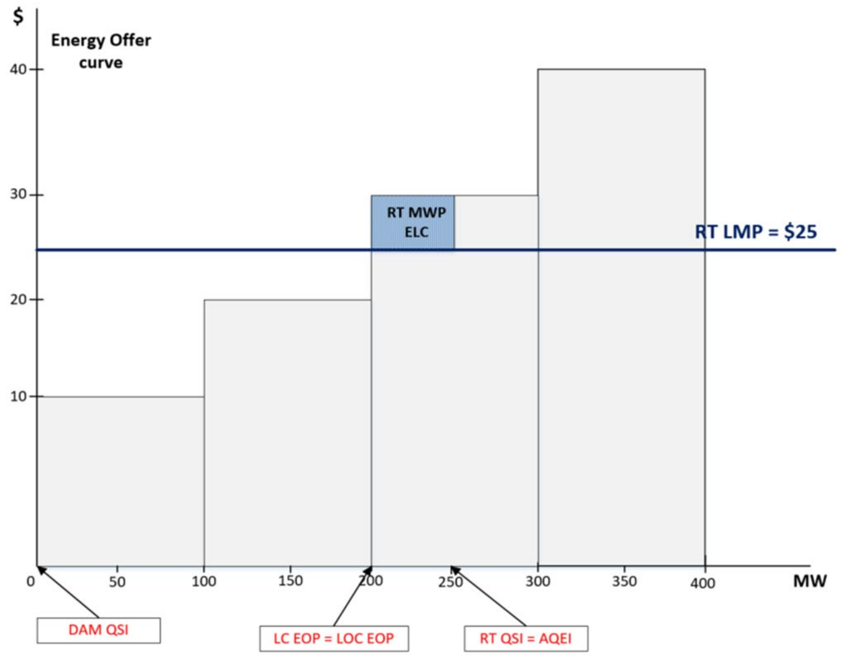
Schedule	Quantity (MW)
RT QSI	250
RT LC EOP	200
DAM_QSI	100

AQEI	250 MW

RT LMP	$25

$$RT\_MWP = \sum^{T} Max(0, RT\_ELC + RT\_OLC) + Max(0, RT\_ELOC + RT\_OLOC)$$

RT_MWP – Scenario 4



Energy RT Lost Cost Calculation		
	OP (Min(RT_QSI, AQEI))	OP (Max(DAM_QSI, RT_LC_EOP))
Revenue	250MW X $25 = $6,250	200MW X $25 = $5,000
Costs	100MW X $10 + 100MW X $20 + 50MW X $30 = $4,500	100MW X $10 + 100MW X $20 = $3,000
Total	$6250 - $4500 = $1,750	$5000 - $3000 = $2,000
RT_ELC	-1 X MIN(0, $1750 - $2000) = $250	

RT_MWP – Scenario 4

Step 2 : Calculate lost opportunity cost for Operating Reserve

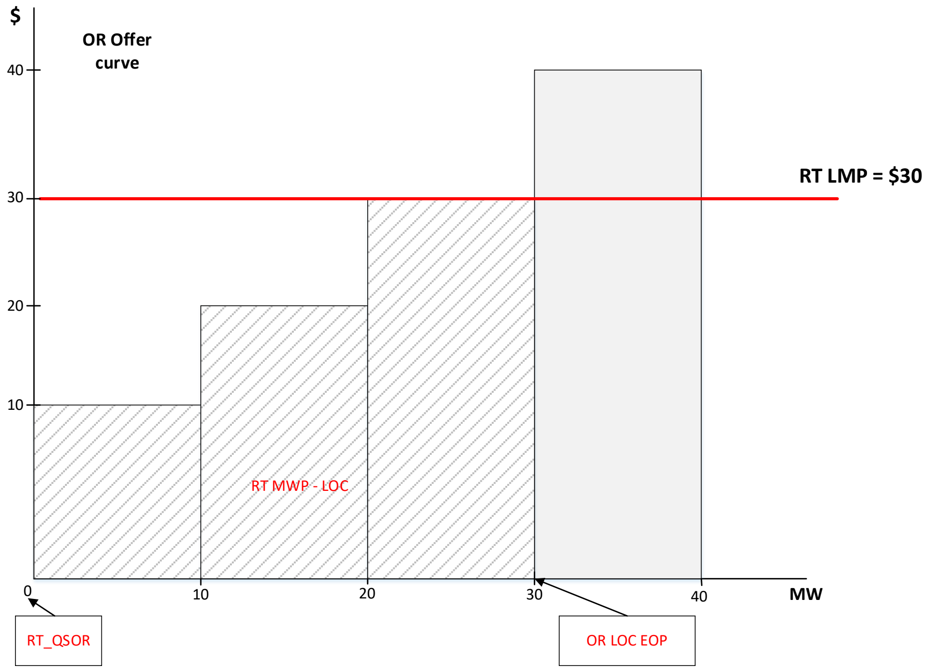
OR Offers – Dispatch Data		
PQ #	Price ($/MWh)	Quantity (MW)
1	10	0
2	10	10
3	20	20
4	30	30
5	40	40

Schedule	Quantity (MW)
RT QSOR	0
DAM QSOR	30
RT LOC OR EOP	30

RT PROR	$30

The generator is activated for 30MW that was scheduled in DAM, therefore it will need to buy-back the 30MW at $30 in RT, however it is eligible for lost opportunity cost.

RT_MWP – Scenario 4



Operating Reserve RT Lost Opportunity Cost Calculation		
	OP (RT_OR_LOC_EOP)	OP (RT_QSOR)
Revenue	30MW X $30 =	0
	$900	$0
Costs	10MW X $10 + 10MW X $20 + 10MW X $30 =	
	$600	$0
Total	$900 - $600 =	
	$300	$0
RT OLOC	$300 - $0 = $300	

RT_MWP – Scenario 4

Step 3 : Compute RT_MWP for energy and OR

$$RT\_MWP_{k,h}^{m} = \sum^{T} Max\left(0, RT\_ELC_{k,h}^{m,t} + RT\_OLC_{k,h}^{m,t}\right) + Max\left(0, RT\_ELOC_{k,h}^{m,t} + RT\_OLOC_{k,h}^{m,t}\right)$$

RT_MWP = Max(0, $250) + $300

= $550

Next Steps

Next Steps:

Throughout December and January: Stakeholders can review appendix material, and request additional examples or scenarios through engagement@ieso.ca

Mid-January: Segmented discussions with stakeholders to review examples/scenarios (Sign Up: https://www.ieso.ca/en/Market-Renewal/Stakeholder-Engagements/Implementation-Engagement-Market-Rules-and-Market-Manuals

February 21: Comments/feedback on market rules and market manuals due to IESO

Thank You

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