

# Variable Generation Contract Settlement with Day-Ahead Market

Presented to: FIT/RES/LRP Wind and Solar Contract Counterparties  
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# Purpose

- To present a proposed comprehensive solution to wind and solar market participant contract holders that addresses the introduction of a Day-Ahead market (DAM)
- To show that the solution results in the same total revenue outcome as before the introduction of DAM, if IESO forecasts are used
- To show that the solution allows deviation from IESO forecasts, which may lead to increased or reduced revenues to the extent of the deviation

# Context

- DAM stakeholder sessions and the high-level design document (HLD) contemplate voluntary participation by all resources
  - Market Power Mitigation applies
  - Caveat in the HLD notes that current Availability Declaration Envelope (ADE) offer obligation would be retained as a transitional measure if incentives are not aligned
- The contract settlement solution presented previously, and further explained in this presentation, aligns contract incentives with market incentives, while retaining the production forecast risk with the IESO

# Previous Meeting Recap

- In October 2018, the mechanics of the contract settlement calculation were presented when comparing present-day real-time contract settlement to post-MRP contract settlement with DAM and real-time
- Two example calculations were previously provided showing:
  - When a generator offers the IESO forecast, revenues are the same post-MRP when compared to present-day settlement
  - When a generator deviates from the IESO forecast, the difference in revenues is solely attributable to the extent of the deviation
- The examples were simple (no curtailment, no deviation in offer price, no negative prices) in order to show that the solution works as intended
- It was requested that these examples be expanded upon, showing other scenarios with varying conditions, and that present-day and post-MRP settlement amounts would still remain the same

# Updates to the Formula

- The formula that was presented in October (and previously to that) is the same that is presented here
  - Contract revenue is equal to output multiplied by contract price, less market revenues at an assumed day ahead forecast
- The formula now includes a condition for negative pricing and separates curtailment compensation
- Condition for assumed day ahead forecast accounts for variation in both quantity and price
- This expanded formula accounts for all conditions and scenarios

# Terms and Variables

- The following represent the variables and terms that are used in the present-day and post-MRP revenue calculations, and the subsequent 18 scenarios

Forecast Quantities	
$F_{DA}$	IESO DA forecast quantity
$F_{RT}$	IESO RT forecast quantity
Offer Prices	
$P_{DA}$	Generator's DA offer price
$P_{RT}$	Generator's RT offer price
Quantities	
$Q_{OFFER}$	Generator's DA offer quantity @ $P_{DA}$
$Q_{DA}^*$	DA scheduled quantity consistent with reference offer
$Q_{DA}$	Actual DA schedule based on generator's offer
$Q_{RT}$	Actual RT production
$Q_X$	Quantity for curtailment compensation if past cap
Market Prices	
$\$_{DA}$	Day Ahead LMP
$\$_{RT}$	Real Time LMP
$\$_{RT}^*$	Real Time LMP adjusted to not less than zero

# Contract Settlement Conditions

- There are two conditions that are used in the contract settlement formula
  - Day-ahead quantity to be used in contract settlement (only applies if quantity offered in day ahead is different from forecast or offer price in day ahead impacts the quantity)
  - Real-time price to account for negative pricing (only applies if offered below \$0)
- $Q_{DA}^*$  reflects the assumed day ahead quantity to be used for contract settlement

If $\$_{DA} > \$0$	$Q_{DA}^* = F_{DA}$	If reference offer is economic, then assume IESO forecast was scheduled
If $\$_{DA} = \$0$	$Q_{DA}^* = \min \text{ of } F_{DA} \text{ and } Q_{DA}$	If reference offer is on the margin then assume actual day ahead schedule up to IESO forecast
If $\$_{DA} < \$0$	$Q_{DA}^* = 0$	If not economic, then assume not scheduled in day-ahead

- $\$_{RT}^*$  reflects the current contract parameter that real time price is assumed to be \$0 if it is negative

If $\$_{RT} \geq \$0$	$\$_{RT}^* = \$_{RT}$
If $\$_{RT} < \$0$	$\$_{RT}^* = \$0$



# General Formulas – Present Day Revenue

Equation shown in previous presentation

Market Revenue

$$Q_{RT} \times \$_{RT}$$

+

Contract Revenue

$$Q_{RT} \times \$_{con} - Q_{RT} \times \$_{RT}$$

+

Add Curtailment Compensation

Modified to reflect settlement for production with negative real time price

Contract Revenue

$$Q_{RT} \times \$_{con} - Q_{RT} \times \$_{RT}^*$$

Collect like terms to show difference in Contract and Real-Time Market Price

Real Time

$$Q_{RT} \times \$_{RT}$$

+

Contract Revenue

$$Q_{RT} \times (\$_{con} - \$_{RT}^*)$$

+

Curtailment

$$Q_X \times \$_{con}$$

Equation with negative pricing accounted per contracts

# General Formulas – Post MRP Revenue

Equation shown in previous presentation

**Market Revenue**  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

**Contract Revenue**  
 $Q_{RT} \times \$_{con} - [(Q_{DA}^* \times \$_{DA}) + (Q_{RT} - Q_{DA}^*) \times \$_{RT}]$

**Add Curtailment Compensation**

Modified to reflect settlement for production with negative real time price

$$Q_{RT} \times \$_{con} - [(Q_{DA}^* \times \$_{DA}) + (Q_{RT} \times \$_{RT}^*) - (Q_{DA}^* \times \$_{RT})]$$

Within square brackets; terms are expanded, then like terms are collected to show change in \$ DA-RT

**Day Ahead**  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

**Real Time**  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

**Contract Revenue**  
 $Q_X \times \$_{con}$

Equation with negative pricing accounted per contracts

# Scenario Overview

- 18 scenarios have been prepared in 5 different categories
  - Base case and 15 possible permutations, where IESO forecast is used are shown, including one scenario where the reference offer is on the margin
  - Two scenarios where the IESO forecast is not used are also shown to illustrate the differences
  - There are over 40 other permutations where IESO forecast is not used that are not shown, as they becomes repetitive of the 15 permutations where day-ahead price or quantity is varied
- Changes to each scenario are variations of the Base Case (Scenario 1 – price and quantities in day-ahead equals price quantities Presented in Slide #23)

Category	Description	Reference
<b>Basic examples</b>	Offer IESO forecast at \$0 in day-ahead and only real-time parameters change	Scenarios 2 to 9, Appendix 2
<b>Real-time curtailment</b>	Same as basic examples with curtailment in real-time	Scenarios 10 to 11, Appendix 3
<b>Negative prices in real-time</b>	Same as basic examples with negatives prices in real-time	Scenarios 12 to 13, Appendix 4
<b>Other examples if offering IESO forecast</b>	Scenarios with day-ahead curtailment, negative prices in day-ahead, and marginal resource schedule	Scenarios 14 to 16, Appendix 5
<b>Deviating from IESO forecasts</b>	Scenarios where IESO forecast is not used	Scenarios 17 to 18, Appendix 6

# Summary of Results

- All scenarios show that the solution works as intended
  - When a generator offers the IESO forecast (scenarios 1 through 16), revenues are the same post-MRP when compared to present-day settlement
  - When a generator deviates from the IESO forecast (scenarios 17 and 18), the difference in revenues is solely attributable to the extent of the deviation
- The following slides show a summary table for each of the 5 categories of scenarios
- Each individual scenario is listed in greater detail with a full calculation in the appendices

# Results – Basic Examples (Scenarios 1-9)

#	Description	Pre-MRP Revenue (Market+Contract+Curtailement) (\$)	Post-MRP Revenue (Market+Contract+Curtailement) (\$)	Difference (\$)	Slide # (Complete Example)
1	RT Quantity, LMP = DA Quantity, LMP	500 + 4500 + 0 = 5000	500 + 4500 + 0 = 5000	0	23-24
2	RT Forecast Quantity ↑	700 + 6300 + 0 = 7000	700 + 6300 + 0 = 7000	0	25-26
3	RT Forecast Quantity ↓	300 + 2700 + 0 = 3000	300 + 2700 + 0 = 3000	0	27-28
4	RT LMP ↑	750 + 4250 + 0 = 5000	500 + 4500 + 0 = 5000	0	29-30
5	RT LMP ↓	250 + 4750 + 0 = 5000	500 + 4500 + 0 = 5000	0	31-32
6	RT Forecast Quantity ↑, RT LMP ↑	1050 + 5950 + 0 = 7000	800 + 6200 + 0 = 7000	0	33-34
7	RT Forecast Quantity ↑, RT LMP ↓	350 + 6650 + 0 = 7000	600 + 6400 + 0 = 7000	0	35-36
8	RT Forecast Quantity ↓, RT LMP ↑	450 + 2550 + 0 = 3000	200 + 2800 + 0 = 3000	0	37-38
9	RT Forecast Quantity ↓, RT LMP ↓	150 + 2850 + 0 = 3000	400 + 2600 + 0 = 3000	0	39-40

# Results – Real-Time Curtailment (Scenarios 10-11)

#	Description	Pre-MRP Revenue (Market+Contract+Curtailment) (\$)	Post-MRP Revenue (Market+Contract+Curtailment) (\$)	Difference (\$)	Slide # (Complete Example)
10	RT Curtailment, RT Forecast Quantity ↑, RT LMP ↓	$0 + 0 + 7000$ = 7000	$600 + (-600) + 7000$ = 7000	0	42-43
11	RT Curtailment, RT Forecast Quantity ↓, RT LMP ↓	$0 + 0 + 3000$ = 3000	$600 + (-600) + 3000$ = 3000	0	44-45

# Results – Negative Prices in Real-Time (Scenarios 12-13)

#	Description	Pre-MRP Revenue (\$) (Market+Contract+Curtailment) (\$)	Post-MRP Revenue (\$) (Market+Contract+Curtailment) (\$)	Difference (\$)	Slide # (Complete Example)
12	RT Price < \$0, not curtailed, RT Forecast Quantity ↑, RT LMP ↓	$(-140) + 7000 + 0$ = 6860	$460 + 6400 + 0$ = 6860	0	47-48
13	RT Price < \$0, not curtailed, RT Forecast Quantity ↓, RT LMP ↓	$(-60) + 3000 + 0$ = 2940	$540 + 2400 + 0$ = 2940	0	49-50

# Results – Other Examples Offering IESO Forecast (Scenarios 14-16)

#	Description	Pre-MRP Revenue (Market+Contract+Curtailement) (\$)	Post-MRP Revenue (Market+Contract+Curtailement) (\$)	Difference (\$)	Slide # (Complete Example)
14	DA curtailment, RT LMP ↑	750 + 4250 + 0 = 5000	750 + 4250 + 0 = 5000	0	52-53
15	DA curtailment, RT curtailment	0 + 0 + 5000 = 5000	0 + 0 + 5000 = 5000	0	54-55
16	RT Forecast Quantity ↑, RT LMP ↑, Marginal Resource	350 + 6650 + 0 = 7000	250 + 6750 + 0 = 7000	0	56-57



# Results – Deviating from IESO Forecasts (Scenarios 17-18)

#	Description	Pre-MRP Revenue (Market+Contract+Curtailment) (\$)	Post-MRP Revenue (Market+Contract+Curtailment) (\$)	Difference (\$)	Slide # (Complete Example)
17	DA Quantity Offer ↑, RT Forecast Quantity ↑, RT LMP ↓	350 + 6650 + 0 = 7000	700 + 6400 + 0 = 7100	+100	59-60
18	DA Quantity Offer ↑, RT Forecast Quantity ↑, RT LMP ↑	1050 + 5950 + 0 = 7000	700 + 6200 + 0 = 6900	-100	61-62

# Conclusion

- If the Supplier's DA offer is consistent with the IESO's default offer (both price and quantity), the post-MRP settlement amount will equal that of present-day
  - This is the case regardless of RT conditions
  - Shown in Appendices 2-5 (Slides 23-57)
- If the Supplier chooses to deviate from the IESO default offer, the post-MRP revenue may not equal present-day revenue
  - The Supplier assumes this risk if they choose to deviate, but only to the extent of the deviation
  - Shown in Appendix 6 (Slides 59-62)

# Next Steps

- Feedback, questions, and requests for further clarity are welcome
- IESO will publish a broader contracts and MRP document in the coming days
- Next step in the coming months will be to start the work on preliminary term sheets
- For questions/comments, contact: [mr.ContractManagement@ieso.ca](mailto:mr.ContractManagement@ieso.ca)

# Appendix 1 – Introduction to Detailed Calculations

# Reading the Detailed Calculations

- Where expanded calculations are provided, present-day calculations are noted in **blue**, post-MRP are noted in **green**
- Numerical changes to conditions in each scenario are noted in **red**
- For each scenario, the same contract parameters are used as follows;

Contract Capacity =	<b>100 MW</b>
Contract Price ( $\$_{\text{Con}}$ ) =	<b>100 \$ / MWh</b>
Contract ref DA offer price	<b>0 \$ / MWh</b>

- Both the Contract Capacity and Contract Price are defined in the contract
  - The Contract Price represents \$/MWh of electricity generated
  - These values are constant through each scenario

# Appendix 2 – Basic Examples (Scenarios 1-9)

# Scenario 1 – Base Case

- RT conditions mimic that of DA conditions
  - The market price is the same in DA vs. RT
  - The DA scheduled offer and quantity equal the RT production quantity

## Real Time

LMP ( $\$_{RT}$ ):	\$10/MW
LMP adj. ( $\$_{RT}^*$ ):	\$10/MW
Actual RT Production ( $Q_{RT}$ ):	50 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 1 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $50 \times 10 = 500$

+

Contract Revenue  
 $50 \times (100 - 10) = 4500$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (50 - 50) \times 10 = 500$

+

Contract Revenue  
 $50 \times 100 - [50 \times (10 - 10) + 50 \times 10] = 4500$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$5000

=

Post-MRP Total Revenue  
 \$5,000



# Scenario 2 – Single Parameter Adjustment

- RT forecast capability is increased by 20 MW
  - Actual RT production will match the new forecast capability
  - The DA and RT market prices are equal

## Real Time

LMP ( $\$_{RT}$ ):	\$10/MW
LMP adj. ( $\$_{RT}^*$ ):	\$10/MW
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	70 MW
Curtailement Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 2 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times 10 = 700$

+

Contract Revenue  
 $70 \times (100 - 10) = 6300$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (70 - 50) \times 10 = 700$

+

Contract Revenue  
 $70 \times 100 - [50 \times (10 - 10) + 70 \times 10] = 6300$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$7,000

=

Post-MRP Total Revenue  
 \$7,000

# Scenario 3 – Single Parameter Adjustment

- RT forecast capability is decreased by 20 MW
  - Actual RT production will match the new forecast capability
  - The DA and RT market prices are equal

## Real Time

LMP ( $\$_{RT}$ ):	\$10/MW
LMP adj. ( $\$_{RT}^*$ ):	\$10/MW
IESO Forecast ( $F_{RT}$ ):	30 MW
Actual RT Production ( $Q_{RT}$ ):	30 MW
Curtailed Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 3 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $30 \times 10 = 300$

+

Contract Revenue  
 $30 \times (100 - 10) = 2700$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (30 - 50) \times 10 = 300$

+

Contract Revenue  
 $30 \times 100 - [50 \times (10 - 10) + 30 \times 10] = 2700$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$3,000

=

Post-MRP Total Revenue  
 \$3,000

# Scenario 4 – Single Parameter Adjustment

- The RT LMP is increased by \$5/MW, now higher than the DA LMP
  - The DA scheduled offer and quantity equal the RT production quantity

## Real Time

LMP ( $\$_{RT}$ ):	\$15/MW
LMP adj. ( $\$_{RT}^*$ ):	\$15/MW
IESO Forecast ( $F_{RT}$ ):	50 MW
Actual RT Production ( $Q_{RT}$ ):	50 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 4 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $50 \times 15 = 750$

+

Contract Revenue  
 $50 \times (100 - 15) = 4250$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (50 - 50) \times 15 = 500$

+

Contract Revenue  
 $50 \times 100 - [50 \times (10 - 15) + 50 \times 15] = 4500$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$5,000

=

Post-MRP Total Revenue  
 \$5,000

# Scenario 5 – Single Parameter Adjustment

- The RT LMP is reduced by \$5/MW, now lower than the DA LMP
  - The DA scheduled offer and quantity equal the RT production quantity

## Real Time

LMP ( $\$_{RT}$ ):	\$5/MW
LMP adj. ( $\$_{RT}^*$ ):	\$5/MW
IESO Forecast ( $F_{RT}$ ):	50 MW
Actual RT Production ( $Q_{RT}$ ):	50 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 5 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $50 \times 5 = 250$

+

Contract Revenue  
 $50 \times (100 - 5) = 4750$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (50 - 50) \times 5 = 500$

+

Contract Revenue  
 $50 \times 100 - [50 \times (10 - 5) + 50 \times 5] = 4500$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$5,000

=

Post-MRP Total Revenue  
 \$5,000



# Scenario 6 – Two Parameter Adjustment

- IESO RT forecast capability is increased 20 MW and the RT LMP Price is increased \$5/MW
  - The actual RT production will equal the new RT forecast capability

## Real Time

LMP ( $\$_{RT}$ ):	\$15/MW
LMP adj. ( $\$_{RT}^*$ ):	\$15/MW
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	70 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 6 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT*})$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times 15 = 1050$

+

Contract Revenue  
 $70 \times (100 - 15) = 5950$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA*} \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT*}]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (70 - 50) \times 15 = 800$

+

Contract Revenue  
 $70 \times 100 - [50 \times (10 - 15) + 70 \times 15] = 6200$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$7,000

=

Post-MRP Total Revenue  
 \$7,000

# Scenario 7 – Two Parameter Adjustment

- IESO RT forecast capability is increased 20 MW and the RT LMP Price is reduced \$5/MW
  - The actual RT production will equal the new RT forecast capability

## Real Time

LMP ( $\$_{RT}$ ):	\$5/MW
LMP adj. ( $\$_{RT}^*$ ):	\$5/MW
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	70 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 7 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times 5 = 350$

+

Contract Revenue  
 $70 \times (100 - 5) = 6650$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (70 - 50) \times 5 = 600$

+

Contract Revenue  
 $70 \times 100 - [50 \times (10 - 5) + 70 \times 5] = 6400$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$7,000

=

Post-MRP Total Revenue  
 \$7,000

# Scenario 8 – Two Parameter Adjustment

- IESO RT forecast capability is reduced 20 MW and the RT LMP Price is increased \$5/MW
  - The actual RT production will equal the new RT forecast capability

## Real Time

LMP ( $\$_{RT}$ ):	\$15/MW
LMP adj. ( $\$_{RT}^*$ ):	\$15/MW
IESO Forecast ( $F_{RT}$ ):	30 MW
Actual RT Production ( $Q_{RT}$ ):	30 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 8 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $30 \times 15 = 450$

+

Contract Revenue  
 $30 \times (100 - 15) = 2550$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (30 - 50) \times 15 = 200$

+

Contract Revenue  
 $30 \times 100 - [50 \times (10 - 15) + 30 \times 15] = 2800$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$3,000

=

Post-MRP Total Revenue  
 \$3,000

# Scenario 9 – Two Parameter Adjustment

- IESO RT forecast capability is reduced 20 MW and the RT LMP Price is reduced \$5/MW
  - The actual RT production will equal the new RT forecast capability

## Real Time

LMP ( $\$_{RT}$ ):	\$5/MW
LMP adj. ( $\$_{RT}^*$ ):	\$5/MW
IESO Forecast ( $F_{RT}$ ):	30 MW
Actual RT Production ( $Q_{RT}$ ):	30 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 9 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $30 \times 5 = 150$

+

Contract Revenue  
 $30 \times (100 - 5) = 2850$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (30 - 50) \times 5 = 400$

+

Contract Revenue  
 $30 \times 100 - [50 \times (10 - 5) + 30 \times 5] = 2600$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$3,000

=

Post-MRP Total Revenue  
 \$3,000



# Appendix 3 – With Real-Time Curtailment (Scenarios 10-11)

# Scenario 10 – Two Parameter Adjustment with RT curtailment

- IESO RT forecast capability is increased 20 MW and the RT LMP Price is now negative
  - Actual RT production is 0 due to LMP being lower than the generator's RT price offer

## Real Time

LMP ( $\$_{RT}$ ):	$\$-2/MW$
LMP adj. ( $\$_{RT}^*$ ):	$\$0/MW$
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	0 MW
Curtailment Quantity ( $Q_x$ ):	70 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	$\$10/MW$
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 10 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $0 \times (-2) = 0$

+

Contract Revenue  
 $0 \times (100 - 0) = 0$

+

Curtailment  
 $70 \times 100 = 7000$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (0 - 50) \times (-2) = 0$

+

Contract Revenue  
 $0 \times 100 - [50 \times (10 - (-2)) + 0 \times 0] = 0$

+

Curtailment  
 $70 \times 100 = 7000$

Pre-MRP Total Revenue  
 \$7,000

=

Post-MRP Total Revenue  
 \$7,000

# Scenario 11 – Two Parameter Adjustment with RT curtailment

- IESO RT forecast capability is reduced 20 MW and the RT LMP Price is now negative
  - Actual RT production is 0 due to LMP being lower than the generator's RT price offer

## Real Time

LMP ( $\$_{RT}$ ):	$\$-2/MW$
LMP adj. ( $\$_{RT}^*$ ):	$\$0/MW$
IESO Forecast ( $F_{RT}$ ):	30 MW
Actual RT Production ( $Q_{RT}$ ):	0 MW
Curtailment Quantity ( $Q_x$ ):	30 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	$\$10/MW$
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 11 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $0 \times (-2) = 0$

+

Contract Revenue  
 $0 \times (100 - 0) = 0$

+

Curtailment  
 $30 \times 100 = 3000$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (0 - 50) \times (-2) = 0$

+

Contract Revenue  
 $0 \times 100 - [50 \times (10 - (-2)) + 0 \times 0] = 0$

+

Curtailment  
 $30 \times 100 = 3000$

Pre-MRP Total Revenue  
 \$3,000

=

Post-MRP Total Revenue  
 \$3,000

# Appendix 4 – Negative Prices in Real-Time (Scenarios 12-13)

# Scenario 12 – Two Parameter Adjustment with RT price offer < \$0

- IESO RT forecast capability is increased 20 MW, the RT LMP Price is now negative, and the RT generator offer price is \$-5/ MW
  - Although RT production is negative, it is higher than the generator offer price, therefore RT production equals the IESO forecast capability

## Real Time

LMP ( $\$_{RT}$ ):	<b>\$-2/MW</b>
LMP adj. ( $\$_{RT}^*$ ):	<b>\$0/MW</b>
IESO Forecast ( $F_{RT}$ ):	<b>70 MW</b>
Actual RT Production ( $Q_{RT}$ ):	<b>70 MW</b>
Curtailed Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 12 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times (-2) = -140$

+

Contract Revenue  
 $70 \times (100 - 0) = 7000$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (70 - 50) \times (-2) = 460$

+

Contract Revenue  
 $70 \times 100 - [50 \times (10 - (-2)) + 70 \times 0] = 6400$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$6,860

=

Post-MRP Total Revenue  
 \$6,860



# Scenario 13 – Two Parameter Adjustment with RT price offer < \$0

- IESO RT forecast capability is reduced 20 MW, the RT LMP Price is now negative, and the RT generator offer price is \$-5/ MW
  - Although RT production is negative, it is higher than the generator offer price, therefore RT production equals the IESO forecast capability

## Real Time

LMP ( $\$_{RT}$ ):	<b>\$-2/MW</b>
LMP adj. ( $\$_{RT}^*$ ):	<b>\$0/MW</b>
IESO Forecast ( $F_{RT}$ ):	<b>30 MW</b>
Actual RT Production ( $Q_{RT}$ ):	<b>30 MW</b>
Curtailed Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	50 MW

# Scenario 13 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $30 \times (-2) = -60$

+

Contract Revenue  
 $30 \times (100 - 0) = 3000$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(50 \times 10) + (30 - 50) \times (-2) = 540$

+

Contract Revenue  
 $30 \times 100 - [50 \times (10 - (-2)) + 30 \times 0] = 2400$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$2,940

=

Post-MRP Total Revenue  
 \$2,940

# Appendix 5 – Other Examples of Offering IESO Forecast (Scenarios 14-16)

# Scenario 14 – DA curtailment, RT production

- The DA LMP is negative in this case
  - This results in a DA scheduled quantity of 0
- RT LMP is increased to \$15/MW
  - Therefore there is RT production

## Real Time

LMP ( $\$_{RT}$ ):	\$15/MW
LMP adj. ( $\$_{RT}^*$ ):	\$15/MW
IESO Forecast ( $F_{RT}$ ):	50 MW
Actual RT Production ( $Q_{RT}$ ):	50 MW
Curtailment Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$-2/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	0 MW
Actual Schedule ( $Q_{DA}$ ):	0 MW

# Scenario 14 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $50 \times 15 = 750$

+

Contract Revenue  
 $50 \times (100 - 15) = 4250$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(0 \times (-2)) + (50 - 0) \times 15 = 750$

+

Contract Revenue  
 $50 \times 100 - [0 \times ((-2) - 15) + 50 \times 15] = 4250$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$5,000

=

Post-MRP Total Revenue  
 \$5,000

# Scenario 15 – DA and RT Curtailment

- The DA LMP is negative in this case
  - This results in a DA scheduled quantity of 0
- RT LMP is also negative in this case
  - Therefore there is also going to be RT curtailment

## Real Time

LMP ( $\$_{RT}$ ):	$\$-2/MW$
LMP adj. ( $\$_{RT}^*$ ):	$\$0/MW$
IESO Forecast ( $F_{RT}$ ):	50 MW
Actual RT Production ( $Q_{RT}$ ):	0 MW
Curtailment Quantity ( $Q_x$ ):	50 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	$\$-2/MW$
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	0 MW
Actual Schedule ( $Q_{DA}$ ):	0 MW

# Scenario 15 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $0 \times (-2) = 0$

+

Contract Revenue  
 $0 \times (100 - 0) = 0$

+

Curtailment  
 $50 \times 100 = 5000$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(0 \times (-2)) + (0 - 0) \times (-2) = 0$

+

Contract Revenue  
 $0 \times 100 - [0 \times ((-2) - (-2)) + 0 \times 0] = 0$

+

Curtailment  
 $50 \times 100 = 5000$

Pre-MRP Total Revenue  
 \$5,000

=

Post-MRP Total Revenue  
 \$5,000

# Scenario 16 – Marginal Resource, Forecast Capability and RT LMP are Increased

- As the DA LMP equals the DA offer price, only 20 MW of DA quantity is required vs the 50 MW that was forecast/offered (marginal)
- RT LMP is above RT price offer
  - Therefore RT production quantity equals RT forecast

## Real Time

LMP ( $\$_{RT}$ ):	\$5/MW
LMP adj. ( $\$_{RT}^*$ ):	\$5/MW
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	70 MW
Curtailed Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$0/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	20 MW
Actual Schedule ( $Q_{DA}$ ):	20 MW



# Scenario 16 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times 5 = 350$

+

Contract Revenue  
 $70 \times (100 - 5) = 6650$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(20 \times 0) + (70 - 20) \times 5 = 250$

+

Contract Revenue  
 $70 \times 100 - [20 \times (0 - 5) + 70 \times 5] = 6750$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$7,000

=

Post-MRP Total Revenue  
 \$7,000

# Appendix 6 – Deviation from IESO Forecast (Scenarios 17-18)

# Scenario 17 – DA Offer Quantity Increased (Deviates from IESO Forecast)

- Deviation from passive operation
- RT forecast capability is increased by 20 MW
- RT LMP is reduced \$5/MW
  - Now lower than the DA LMP

## Real Time

LMP ( $\$_{RT}$ ):	\$5/MW
LMP adj. ( $\$_{RT}^*$ ):	\$5/MW
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	70 MW
Curtailed Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	70 MW

# Scenario 17 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$

+

Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times 5 = 350$

+

Contract Revenue  
 $70 \times (100 - 5) = 6650$

+

Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$

+

Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$

+

Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(70 \times 10) + (70 - 20) \times 5 = 700$

+

Contract Revenue  
 $70 \times 100 - [50 \times (10 - 5) + 70 \times 5] = 6400$

+

Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$7,000



Post-MRP Total Revenue  
 \$7,100

# Scenario 18 – DA Offer Quantity Increased (Deviates from IESO Forecast)

- Deviation from passive operation
- RT forecast capability is increased by 20 MW
- RT LMP is increased \$5/MW
  - Now higher than the DA LMP

## Real Time

LMP ( $\$_{RT}$ ):	\$15/MW
LMP adj. ( $\$_{RT}^*$ ):	\$15/MW
IESO Forecast ( $F_{RT}$ ):	70 MW
Actual RT Production ( $Q_{RT}$ ):	70 MW
Curtailed Quantity ( $Q_x$ ):	0 MW

## Day Ahead

LMP ( $\$_{DA}$ ):	\$10/MW
IESO Forecast ( $F_{DA}$ ):	50 MW
Scheduled Quantity ( $Q_{DA}^*$ ):	50 MW
Actual Schedule ( $Q_{DA}$ ):	70 MW

# Scenario 18 - Calculations

Real Time  
 $Q_{RT} \times \$_{RT}$



Contract Revenue  
 $Q_{RT} \times (\$_{con} - \$_{RT}^*)$



Curtailment  
 $Q_X \times \$_{con}$

Real Time  
 $70 \times 15 = 1050$



Contract Revenue  
 $70 \times (100 - 15) = 5950$



Curtailment  
 $0 \times 100 = 0$

Day Ahead      Real Time  
 $(Q_{DA} \times \$_{DA}) + (Q_{RT} - Q_{DA}) \times \$_{RT}$



Contract Revenue  
 $Q_{RT} \times \$_{con} - [Q_{DA}^* \times (\$_{DA} - \$_{RT}) + Q_{RT} \times \$_{RT}^*]$



Curtailment  
 $Q_X \times \$_{con}$

Day Ahead      Real Time  
 $(70 \times 10) + (70 - 20) \times 15 = 700$



Contract Revenue  
 $70 \times 100 - [50 \times (10 - 15) + 70 \times 15] = 6200$



Curtailment  
 $0 \times 100 = 0$

Pre-MRP Total Revenue  
 \$7,000



Post-MRP Total Revenue  
 \$6,900