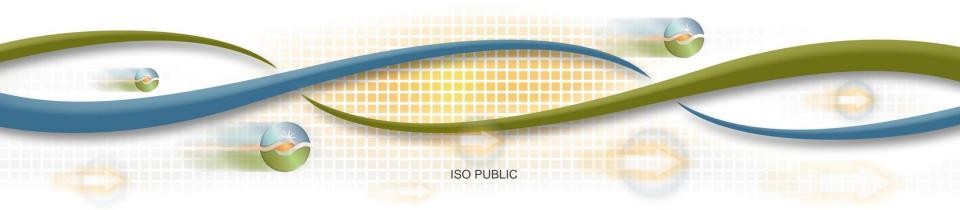# Powerex EIM Implementation
Informational Call

Mark Holman, Powerex

Don Tretheway, California ISO

October 3, 2017

Agenda

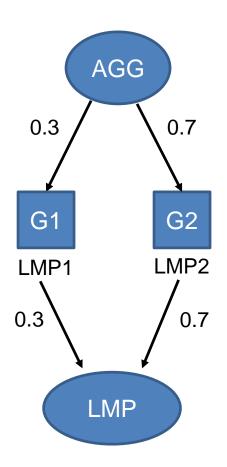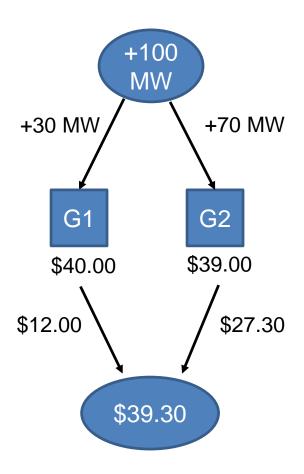| Time	Topic	Presenter
9:00 – 9:05	Introduction	Kristina Osborne, ISO
9:05 – 10:05	Powerex Modeling in EIM	Mark Holman, Powerex
10:05 – 11:05	Powerex Participation in EIM	Don Tretheway, ISO
11:05 – 12:00	Q&A	All

POWEREX MODELING

RESOURCE AGGREGATION

Powerex meets CAISO resource aggregation requirements

- No enforcement of transmission constraints in BC Hydro BAA so no congestion impact on aggregate resource LMPs from transmission within BC Hydro BAA

- Since radial to US, very similar shift factors from individual resources within resource aggregation to enforced constraints outside BC Hydro BAA in EIM area

- Resource aggregation as proposed has an accurate impact on enforced transmission constraints in EIM area

- Resource aggregation meeting CAISO requirements has always been available to EIM entities

Generation distribution factors (GDF) used to accurately model flows from underlying resources

GDF are determined by BC Hydro and communicated to CAISO on hourly basis

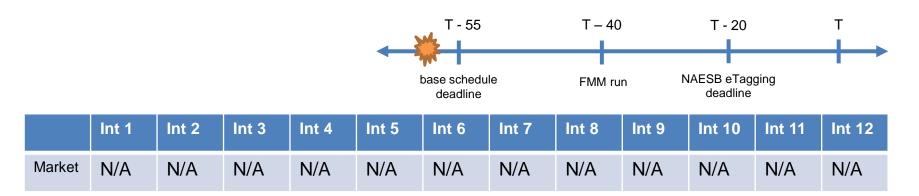# MARKET TIMELINES AND INFORMING EIM MARKET

California ISO

Imbalance energy is priced based on when the bilateral schedule change is known by the market

- ISO market is aware of schedule change **before** FMM run
  - Results in fifteen minute (FMM) settlement

- ISO market is aware of schedule change **after** FMM run
  - Results in real time dispatch (RTD) settlement

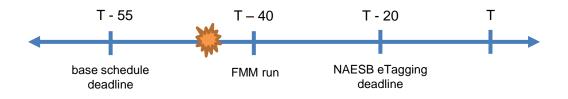# For each scenario, we assume the following …

- 50 MW export schedule increase is approved by BAA
  - Pays the LMP & EIM admin fee

- 50 MW manual dispatch is communicated to ISO
  - Paid the LMP & pays EIM admin fee

- Net settlement is difference between congestion & losses

California ISO

Export and resource base schedules change known prior to EIM entity submission deadline

	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6	Int 7	Int 8	Int 9	Int 10	Int 11	Int 12
Market	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

- Merchant can enter schedule changes into BSAP before deadline (Resource sufficiency test at T-55)
- No need for manual dispatch
- No imbalance settlement
- Information provided by EIM participating resource SC
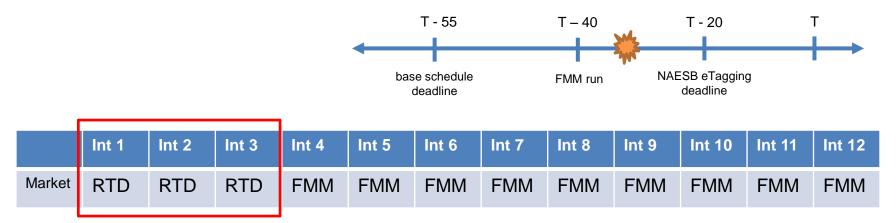- Information for non-participating resources provided by Canadian Entity (Powerex)

California ISO

Export schedule submitted between T-55 & T-40, EIM Entity SC or Canadian Entity updates base schedules before ISO submission deadline

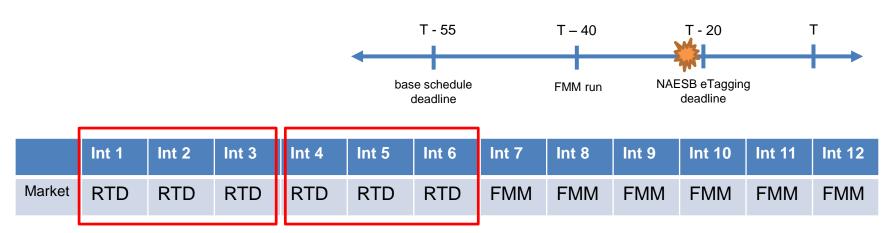|	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6	Int 7	Int 8	Int 9	Int 10	Int 11	Int 12
Market	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

- Final (3rd) resource sufficiency evaluation at T-40

- No need for manual dispatch

- No imbalance settlement

- Information for non-participating resources provided through BSAP by EIM Entity SC or Canadian Entity based on BC Hydro input

California ISO

Export approved by EIM entity BAA or BC Hydro and communicated between T-40 & T-25

Market	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6	Int 7	Int 8	Int 9	Int 10	Int 11	Int 12
	RTD	RTD	RTD	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM

- Creates imbalance that is resolved through the market
  - Settled at RTD price for Int 1 – Int 3
  - Settled at FMM price for Int 4 – Int 12
- EIM Entity communicates manual dispatch to inform EIM market
- Canadian Entity will rely on auto-matching feature to inform EIM market

Export approved by EIM Entity BAA or BC Hydro and communicated between T-25 & T-20

Timeline:
- T - 55 — base schedule deadline
- T – 40 — FMM run
- T - 20 — NAESB eTagging deadline
- T

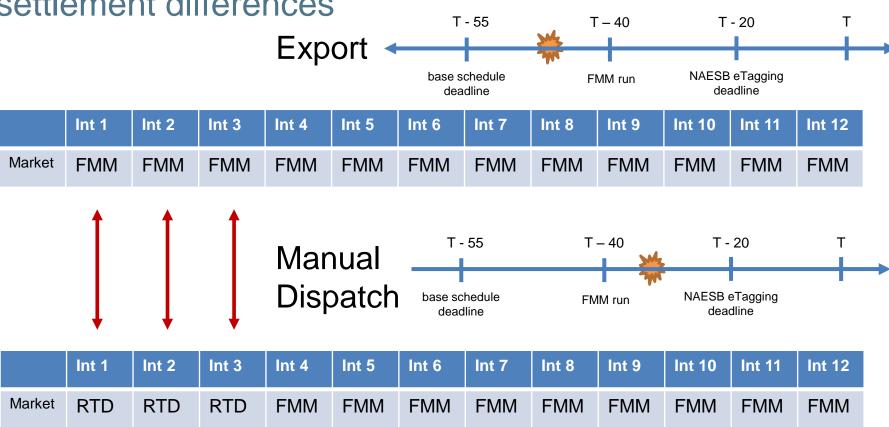| Market	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6	Int 7	Int 8	Int 9	Int 10	Int 11	Int 12
	RTD	RTD	RTD	RTD	RTD	RTD	FMM	FMM	FMM	FMM	FMM	FMM

- Creates imbalance that is resolved through the market
  - Settled at RTD price for Int 1 – Int 6
  - Settled at FMM price for Int 7 – Int 12
- EIM Entity communicates manual dispatch to inform EIM market
- Canadian entity will rely on auto-matching feature to inform EIM market

California ISO

Manual dispatch not communicated at the same time as export introduces inaccurate EIM modeling, dispatch, and settlement differences

Export

	T - 55	T – 40	T - 20	T
	base schedule deadline	FMM run	NAESB eTagging deadline	

	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6	Int 7	Int 8	Int 9	Int 10	Int 11	Int 12
Market	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM

Manual Dispatch

	T - 55	T – 40	T - 20	T
	base schedule deadline	FMM run	NAESB eTagging deadline	

	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6	Int 7	Int 8	Int 9	Int 10	Int 11	Int 12
Market	RTD	RTD	RTD	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM	FMM

- EIM responds to export unnecessarily
- Net settlement, charged FMM price and paid RTD price

California ISO

If the export is with Alberta, the imbalance settlement is unchanged, but no EIM admin fee

- 50 MW export schedule increase is approved
  - Pays the LMP ~~& EIM admin fee~~

- 50 MW auto-match to non-participating resource
  - Paid the LMP ~~& pays EIM admin fee~~

California ISO

METERING AND SETTLEMENT

Aggregation does not change resource or load settlement by the ISO

- APR dispatched and settled like any other EIM participating resources

- ANPR settled like any other EIM non-participating resource

- AVR is dispatched at its forecast and settled like any other EIM non-participating resource that is a variable energy resource

- Load deviations from base schedules are settled hourly at the hourly ELAP price as in any other EIM BAA

Settlement example of APR and ANPR with same physical resources in aggregation

	Base	FMM	RTD	Meter	UIE
APR	0	+10	-5	5	0
ANPR	100	+20	0	119	-1
Total	100	+30	-5	124	-1

* Using MW for simplicity

1. APR receives dispatch instructions based on economic bids
2. ANPR is adjusted in FMM to auto-match bilateral export
3. Underlying individual resources' revenue grade meters are summed for total output of aggregation
4. Total output is then distributed to establish logical meter value for APR and ANPR

Consolidated EIM Initiatives

NEW EIM FUNCTIONALITIES

California ISO

Additional details published in EIM Enhancements Winter 2017 BRS

- Draft Final Proposal explains benefit provided to EIM Entities

- BRS explains business rules and details:

  http://www.caiso.com/Documents/BusinessRequirementsSpecification-EIMWinter2017Enhancements.pdf

California ISO

Automated matching of import/export schedule changes with a single EIM non-participating resource (1 of 3)

- Auto-adjustment of non-participating resource schedules to match import or export schedule changes after T-40

- Eliminates the need to manually communicate dispatch changes of the non-participating resource

- Facilitates communication of changes to base schedules

- Currently two solutions to resolve imbalance due to a schedule changes after T-40

    1. BAA Operator manually dispatches a generator

    2. EIM entity allows market to resolve imbalance using participating resources bid stack

- New functionality presents third option:

    3. Allow a NPR's schedule to automatically adjust when an intertie schedule change occurs
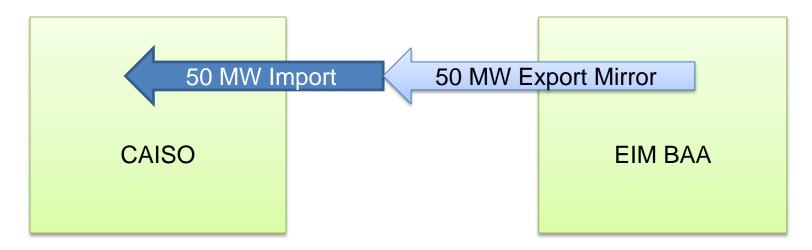
- Implemented in two phases:
    1. Only one NPR to intertie schedule change set
    2. Multiple NPR and intertie schedule change sets

- Enables most efficient use of resources and preserves participating resource bid range
    – Settled as a manual dispatch instruction
    – Auto-matched changes won't impact capacity test requirement

- Minimizes errors that may result from operator manual dispatches

- Timely informs the market about bilateral schedule changes

Automated mirror system resources at ISO intertie scheduling points (1 of 3)

- Mirror system resources allow the market to solve for the ISO and another EIM Entity at the same time

- 50 MW import to the ISO BAA and corresponding 50 MW mirror export schedule out of an EIM BAA at an ISO intertie scheduling point

- Currently, EIM Entity Scheduling Coordinators are responsible to submit base schedules and manually update them for mirror system resources

- This enhancement will automate the mirroring of ISO import/export schedule changes at ISO scheduling points after T-40

- Similar to auto-matching, this functionality automates the communication of information to the ISO

- Eliminates required manual adjustment to mirror when schedule changes occurs after T-40

- Automated mirror system resource must only mirror ISO import/export self-schedules

- Can be auto-matched to a NPR

Base EIM transfer system resource imbalance settlement

- Will provide EIM entities with settlement information for base ETSR schedule changes
  - Determine financial location of LMP of base ETSR
  - Source and Sink entities must agree upon and provide information to the ISO

- The ISO will not require EIM entities use this data but it may facilitate settlement of bilateral transactions

Allow submission of base generation distribution factors (GDFs) for aggregated EIM non-participating resources

- The market will distribute the base schedule and any imbalances of aggregate EIM non-participating resources using the submitted base GDFs

- Base GDFs will also be used to calculate the aggregate LMP for the aggregate EIM non-participating resource

- Hourly submission of base GDFs enables accurate modeling and allows the market to run efficiently and economically

Leveraging non-generator resource (Generic NGR) modeling functionality (1 of 3)

- Generic NGR modeling functionality available in all ISO markets (IFM, FMM, RTD)
  - Aggregated and non-aggregated
  - Market does not observe state of charge limits or constraints

- Generic NGRs can provide positive and negative energy
  - Must have generating capabilities

- Not subject to demand charges for negative generation

Leveraging non-generator resource (NGR) modeling functionality (2 of 3)

- Will be subject to local market power mitigation (LMPM) based upon underlying technology
  - Traditional generators will be subject to mitigation
  - DER, PDR, & storage will continue to not be subject to mitigation

- Is not eligible for resource adequacy at this time

- Can provide AS and RUC
  - Intertie resource w/out a forward energy schedule will be able to provide regulation down to the ISO

Leveraging non-generator resource (NGR) modeling functionality (3 of 3)

- Additional description of NGR enhancements can be found in section 6.2 of the Energy Storage Distributed Energy Resources (ESDER) Phase 2 draft final proposal:

  http://www.caiso.com/Documents/DraftFinalProposal-EnergyStorage_DistributedEnergyResourcesPhase2.pdf

EXAMPLES OF PAST AND FUTURE IMPLEMENTATION DRIVEN EIM ENHANCEMENTS

Implementation Driven EIM Enhancements

- CAISO has frequently added functionality as new EIM Entities join to accommodate a broader range of circumstances

- This functionality is consistent with the core design of the EIM

- When functionality is added, it is made available to all EIM Entities

- Functionality added to support Powerex's participation is no different

Implementation Driven EIM Enhancements

- BSAP – Minimize PAC need to develop interface for their customers

- EIM Year 1 Phase 1 – NVE energy use of ATC, tagging rules

- EIM Year 1 Phase 2 – PSE use of OMS

- New EIM functionality – Powerex

Implementation Driven EIM Enhancements

- PAC BA agent within PAC merchant
- SMUD sub BAA within BANC
- BPA ROC constraints, CTA and DTC on COI
- PX no congestion management within BC Hydro BAA
- JIM Bridger operation in PAC with Idaho share handling
- DTC over Idaho system between PAC West and East

California ISO

Implementation Driven EIM Enhancements

- CAISO inter-tie bidding (scheduling) points within EIM BAA

- Dynamic share movement within the hour (APS Paloverde)

- Splitting ETSRs between base flows and EIM flows (APS-NVE, NVE-PAC)

- Separate forecast zones for one EIM entity (PACW, PACE)

- Separate forecast zones for one EIM entity within 1 BAA (NVE)

California ISO