CRR Auction Efficiency 1B Update

Date: 2/06/2019

Agenda

- Purpose
- Summary of issues received for CRR 1B
- Demonstration of hourly calcs
- Availability of Settlement data
- Data sources
- Open issues

Purpose

- Holistic review of CRR 1B questions from CIDI tickets, disputes, and SC topics
- Review of CRR 1B implementation, calculation and issues
  - CRR 1B changes took effect 1/1/2019, PRR #1100
  - Linking SC available reports to inputs and calcs relevant to CRR Settlements
  - Data sources – BPMs, OASIS, CMRI report, CRR MUI
  - Intermediate bill determinants in Settlements

CRR 1B provided training

- Completed Oct 31, 2018. Presentation contained: purpose of CRR 1B, timeline, Settlements changes, reporting (in CMRI, OASIS), BPMs, references to BRS, Tariff, and stakeholder initiative page

CRR 1B Shadow calculations

- Notional revenue per constraint per CRR:
- CRR award MW * (constraint source shift factor – constraint sink shift factor) * constraint shadow price * (-1)
  - (-1) does not apply to Flowgate congestion
  - Convention: positive revenue value is a payment to the CRR holder
  - To compare with pre-existing settlement, add notional revenue up for all constraints in the hour, compare with revenue value calculated using the pre-existing methodology. Values should be largely the same.

CRR 1B Shadow calculations

- CRR award MW comes from OASIS
  - Congestion Revenue Rights > CRR Inventory report

Date From: 01/31/2019 To: 01/31/2019 Market Name: LM_LT_2019_2027_201801 Term of Market: [ALL] Time of Use: [ALL] Apply Reset

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CRR Inventory

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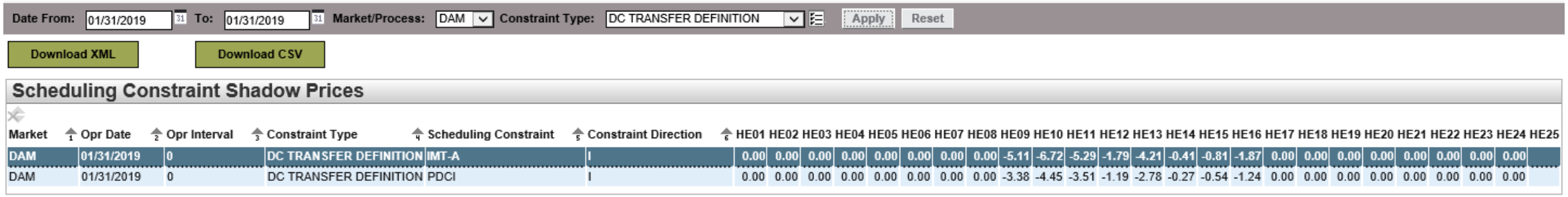
Market Name	Market Term	Time of Use	Source AP Node ID	Sink AP Node ID	Inventory Date	Start Date	End Date	CRR ID	MW Amount	Owner Name	NSR Index	Segment	CRR Type	CRR Category	CRR Option
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	AVSOLAR_7_N008	01/30/2019	01/01/2019	03/31/2019 23:59:59	39499860	0.00300	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	AVSOLAR_7_N008	01/30/2019	01/01/2019	03/31/2019 23:59:59	39494049	0.00100	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	BELDEN_7_B1	01/30/2019	01/01/2019	03/31/2019 23:59:59	39499859	0.00400	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	BELDEN_7_B1	01/30/2019	01/01/2019	03/31/2019 23:59:59	39494048	0.00100	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	BRODIE_2_WIND-APND	01/30/2019	01/01/2019	03/31/2019 23:59:59	39499857	0.00200	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	BRODIE_2_WIND-APND	01/30/2019	01/01/2019	03/31/2019 23:59:59	39494047	0.00100	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	CARBOU_7_PL2X3-APND	01/30/2019	01/01/2019	03/31/2019 23:59:59	39499855	0.00100	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	COGNTNL_7_B1	01/30/2019	01/01/2019	03/31/2019 23:59:59	39499854	0.00100	PCG2	1		LMT_CNT	PTP	OBLIGATION
LM_LT_2019_2027_201801	Load Migration	OFF_PEAK	DLAP_PGAE-APND	HALSEYF_7_B1	01/30/2019	01/01/2019	03/31/2019 23:59:59	39499935	0.00100	PCG2	1		LMT_CNT	PTP	OBLIGATION

CRR 1B Shadow calculations

- Constraint shadow price comes from OASIS
  - Prices > Nomogram/Branch Shadow Prices report
  - Prices > Intertie Constraint Shadow Prices report
  - Prices > Scheduling Constraint Shadow Prices report



Date From: 01/31/2019 To: 01/31/2019 Market/Process: DAM Constraint Type: DC TRANSFER DEFINITION Apply Reset

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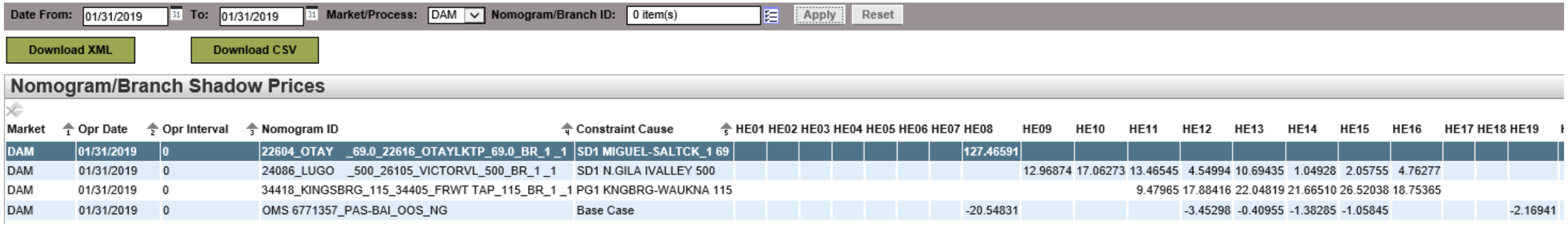
Scheduling Constraint Shadow Prices

Market	Opr Date	Opr Interval	Constraint Type	Scheduling Constraint	Constraint Direction	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24	HE25
DAM	01/31/2019	0	DC TRANSFER DEFINITION	IMT-A	I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.11	-6.72	-5.29	-1.79	-4.21	-0.41	-0.81	-1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
DAM	01/31/2019	0	DC TRANSFER DEFINITION	PDCI	I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-3.38	-4.45	-3.51	-1.19	-2.78	-0.27	-0.54	-1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

CRR 1B Shadow calculations

- Constraint type comes from OASIS (for using -1 multiplier)
  - Prices > Nomogram/Branch Shadow Prices report see below
  - Prices > Intertie Constraint Shadow Prices report use -1
  - Prices > Scheduling Constraint Shadow Prices report use -1

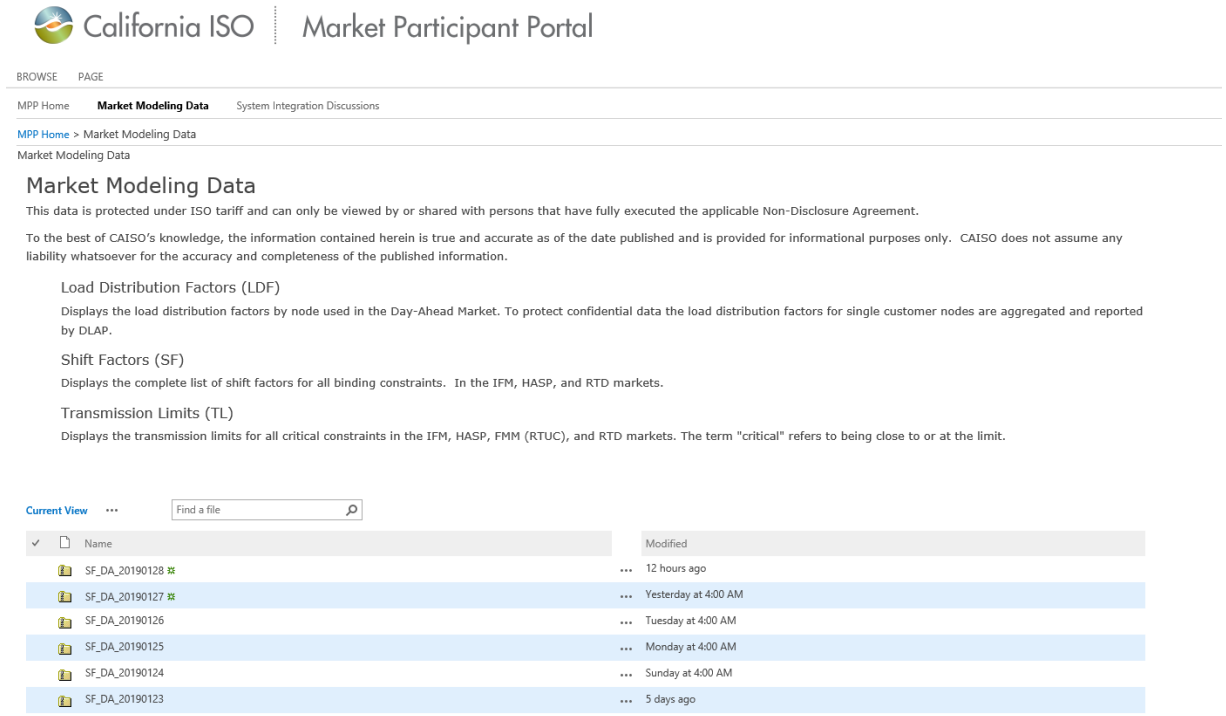


Market	Opr Date	Opr Interval	Nomogram ID	Constraint Cause	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19
DAM	01/31/2019	0	22604_OTAY _69.0_22616_OTAYLKTP_69.0_BR_1 _1	SD1 MIGUEL-SALTCK_1 69								127.46591											
DAM	01/31/2019	0	24086_LUGO _500_26105_VICTORVL_500_BR_1 _1	SD1 N.GILA IVALLEY 500									12.96874	17.06273	13.46545	4.54994	10.69435	1.04928	2.05755	4.76277			
DAM	01/31/2019	0	34418_KINGSBRG_115_34405_FRWT TAP_115_BR_1 _1	PG1 KNGBRG-WAUKNA 115											9.47965	17.88416	22.04819	21.66510	26.52038	18.75365			
DAM	01/31/2019	0	OMS 6771357_PAS-BAI_OOS_NG	Base Case								-20.54831				-3.45298	-0.40955	-1.38285	-1.05845				-2.16941

  - "NOMOGRAM_ID" contains 'NG' – it's a nomogram (multiply by -1)
  - "NOMOGRAM_ID" contains a 5 digit number or 'BG' – it's a flowgate (do not use -1)

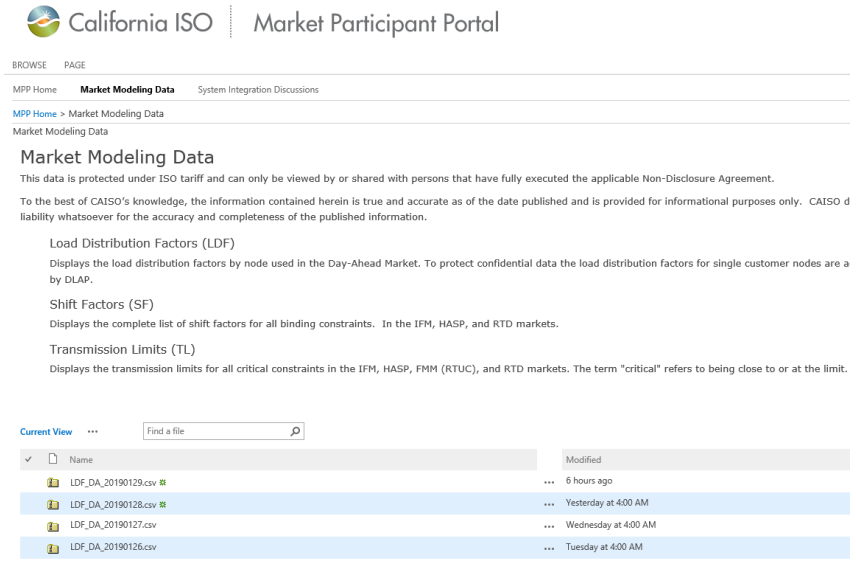
CRR 1B Shadow calculations 1b

- Shift factor comes from the portal
  - MPP Home > Market Modeling Data, Shift Factors, DA
  - Only available to entities that have signed an NDA



CRR 1B Shadow calculations

- To derive shift factors at the DLAP, the load distribution factor (LDF) file is required as well.
- Take the shift factors at the constituent Pnodes, multiply each one by the pnode load distribution factor, and then sum the results up.
  - MPP Home > Market Modeling Data, Load Distribution Factors, DA



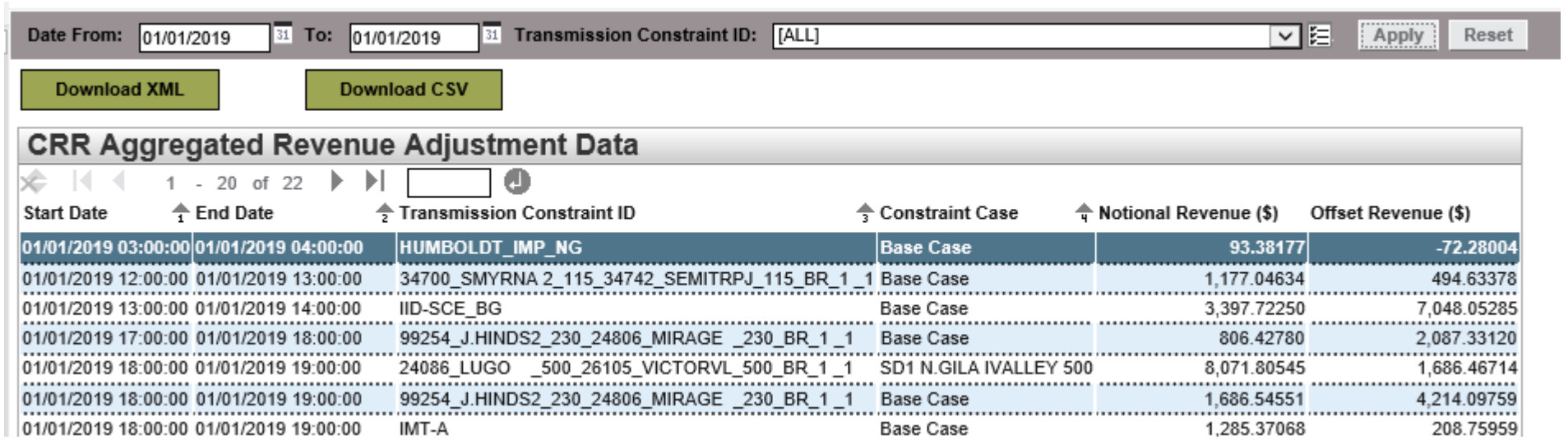
CRR 1B Shadow calculations

- Example of notional revenue calculation:
  - CRR #123456 Award = 125 MW
  - Constraint ABC_NG shadow price =$12.50
  - Shift factor at source location DEF_GN01 = 0.125
  - Shift factor at sink location DLAP_PGAE_APND = -0.025

- Notional revenue = 125*(0.125-(-0.025))*12.5*-1=-$234.375

CRR 1B Shadow calculations

- Offset revenue per constraint per portfolio:
  - Described in Congestion Revenue Rights BPM, section J.6.
  - Finding the necessary data is described in previous slides.
  - Additionally, the total offset revenue and clawback revenue is on OASIS:
    - Congestion Revenue Rights > CRR Aggregate Revenue Adjustment Data



Start Date	End Date	Transmission Constraint ID	Constraint Case	Notional Revenue ($)	Offset Revenue ($)
01/01/2019 03:00:00	01/01/2019 04:00:00	HUMBOLDT_IMP_NG	Base Case	93.38177	-72.28004
01/01/2019 12:00:00	01/01/2019 13:00:00	34700_SMYRNA 2_115_34742_SEMITRPJ_115_BR_1 _1	Base Case	1,177.04634	494.63378
01/01/2019 13:00:00	01/01/2019 14:00:00	IID-SCE_BG	Base Case	3,397.72250	7,048.05285
01/01/2019 17:00:00	01/01/2019 18:00:00	99254_J.HINDS2_230_24806_MIRAGE _230_BR_1 _1	Base Case	806.42780	2,087.33120
01/01/2019 18:00:00	01/01/2019 19:00:00	24086_LUGO _500_26105_VICTORVL_500_BR_1 _1	SD1 N.GILA IVALLEY 500	8,071.80545	1,686.46714
01/01/2019 18:00:00	01/01/2019 19:00:00	99254_J.HINDS2_230_24806_MIRAGE _230_BR_1 _1	Base Case	1,686.54551	4,214.09759
01/01/2019 18:00:00	01/01/2019 19:00:00	IMT-A	Base Case	1,285.37068	208.75959

CRR 1B Shadow calculations

- Clawback revenue per constraint per CRR:
  - Described in Congestion Revenue Rights BPM, section J.4.

CRR 1B Daily calculations

- Revenue per constraint per day per SC:
  - Add up Notional Revenue per hour to get notional revenue per day
  - Same for CRR Clawback Revenue
  - Add up Offset Revenue
    - If negative, it is a reduction in daily payment
    - If positive, it is a surplus that can offset shortfalls in other days of the month
  - Sign convention: positive is revenue to SC

CRR 1B Daily calculations

- Example: Total revenues for PDCI constraint for SC01 for 1/30/19
- Daily notional revenue = $8649.68
- Daily offset revenue = - $5204.20 (offsets the positive notional revenue)
- Daily clawback revenue = -$10.20

CRR Revenue Adjustments

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Start Date	End Date	SC ID	Transmission Constraint ID	Constraint Case	CRR ID	Hedge Type	CRR Type	Notional Revenue ($)	Offset Revenue ($)	CRR Clawback Revenue ($)	Circular Scheduling Revenue ($)
1/30/2019 6:00	1/30/2019 7:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	374.1	18.43	-10.20	0
1/30/2019 7:00	1/30/2019 8:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	911.46	-464.3	0	0
1/30/2019 8:00	1/30/2019 9:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	1,743.43	-1,190.24	0	0
1/30/2019 9:00	1/30/2019 10:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	1,088.02	-856.3	0	0
1/30/2019 10:00	1/30/2019 11:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	561.42	-435.56	0	0
1/30/2019 11:00	1/30/2019 12:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	870.54	-685.13	0	0
1/30/2019 12:00	1/30/2019 13:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	5.11	4.35	0	0
1/30/2019 13:00	1/30/2019 14:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	566.92	-446.18	0	0
1/30/2019 14:00	1/30/2019 15:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	242.91	-172.53	0	0
1/30/2019 15:00	1/30/2019 16:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	446.55	-317.18	0	0
1/30/2019 16:00	1/30/2019 17:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	1,345.38	-811.78	0	0
1/30/2019 17:00	1/30/2019 18:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	76.72	26.66	0	0
1/30/2019 18:00	1/30/2019 19:00	SC01	PDCI	Base Case	0	OBLIGATION	AGG	417.12	125.56	0	0

CRR 1B Daily calculations – Intermediate Bill Determinants

- Intermediate bill determinants
  - **BA_DAY_CRR_DEFICIT@AMOUNT** (BADailyCRRDeficitAmount) – please refer to BPM CC 6700 formula 3.6.5, negative-valued offset quantities BADailyCRROffsetRevenue (BA_DAY_CRR_OFFSET_AMT)
  - **BA_DAY_CRR_SURPLUS@AMOUNT** (BADailyCRRSurplusAmount) – please refer to BPM CC 6700 formula 3.6.11 , positive-valued offset quantities BADailyCRROffsetRevenue (BA_DAY_CRR_OFFSET_AMT)
  - **BA_DAY_CRR_INTERIM_VALUE@AMOUNT** (BADailyCRRInterimValue) – please refer to BPM CC 6700 formula 3.6.7, summation of attributes Transmission constraint and contingency case for variable BADailyCRRConstraintSettlementValue (BA_DAY_CRR_CNST_STLMT_VALUE@AMOUNT)

Upcoming CMRI report with CRR info

Project Info	Details/Date
Application Software Changes	CAISO will provide the following CRR-specific information in a new CMRI report, per binding constraint and time interval • CRR ID • Hedge Type (option or obligation) • CRR Type (LSE, AUC, etc.) • Hourly Notional Revenue • Hourly CRR Clawback Revenue • Hourly Circular Scheduling Revenue • De-rate factor (applies to merchant TOR CRRs) • CRR award MW This information will be provided for each CRR at a unique source and sink location. If an SC has multiple CRRs at the same source and sink, result will be based on the net award value

Milestone Type	Milestone Name	Dates	Status
External BRS	Post Updated External BRS	Jan 18, 2019	✓
Tech Spec	Create ISO Interface Spec (Technical specification)	Feb 8, 2019	
Market Sim	CMRI report available in MAP Stage	Mar 1, 2019	
Production	Activation	Mar 21, 2019	

CMRI - CRR Revenue Adjustment Details – Sample Data

(Subject to change per design and implementation)

Start Date	End Date	SC ID	Transmission Constraint ID	Constraint Case	CRR ID	Hedge Type	CRR Type	Notional Revenue [$]		CRR Clawback Revenue [$]	Circular Scheduling Revenue [$]	Derate Factor	CRR Award MW
09/01/2018 00:00:00	09/01/2018 01:00:00	SC01	MALIN500	Base Case	36206971	OBLIGATIONS	LSE	52.74	52.74+ 26.88+ 56.80 =136.42	0.00	0.00	1.00	1.00
09/01/2018 00:00:00	09/01/2018 01:00:00	SC01	MALIN500	Base Case	36207895	OBLIGATIONS	LSE	26.88		0.00	0.00	1.00	1.00
09/01/2018 00:00:00	09/01/2018 01:00:00	SC01	MALIN500	Base Case	36208515	OBLIGATIONS	AUC	56.8		0.00	0.00	1.00	1.00
09/01/2018 00:00:00	09/01/2018 01:00:00	SC01	NOB_ITC	Base Case	46206643	OBLIGATIONS	AUC	5.21	5.21+ 21.41 =26.62	0.00	0.00	0.01	1.00
09/01/2018 01:00:00	09/01/2018 02:00:00	SC01	NOB_ITC	Base Case	46209895	OBLIGATIONS	LSE	21.41		0.00	0.00	0.01	1.00

Rule for Netting Individual CRRs by source and sink

- For the new CMRI report CRR ID will be the value as derived under the netting process that has been performed prior to the CRR 1B calculation.
- The netting is performed by CRR type and by CRR source/sink combination
- For example, assume an entity holds the following CRRs pre-netting:
  - CRR1 A to B 10MW AUC
  - CRR2 A to B 5MW LSE
  - CRR3 B to A 2MW LMT_CNT
- Post-netted CRRs would be:
  - CRR1 A to B 10MW AUC
  - CRR2 A to B 3MW LSE
- More information can be found in the BPM for CRRs in section 17

FERC filing – CRR 1B

- Filed on 7/17/18 -- CRR 1B initial filing
  - Settle at the CRR ID by constraint by contingency
- FERC response on 9/20/18
  - Rejected portion of initial filing, instructed ISO to net CRRs by constraint by contingency in each hour
- ISO Compliance filing on 10/01/18
  - ISO agreed to net CRRs by constraint by contingency, CRR type, respecting time of use
  - Obligation CRRs are aggregated/netted, Options are not

CRR 1B Open Issues

Issue	Impact
For ITC congestion, shift factors are missing at some locations.	CRRs which source at an intertie may not always be settled for ITC congestion.
Shift factor correction process is sometimes overcorrecting anode shift factors.	CRRs which source or sink at an APnode may get an incorrect settlement.
For flowgate and nomogram type congestion, shift factors are not being published at some anode locations. Due to 2% publishing rule.	CRRs which source or sink at an APnode may get an incorrect settlement.

Data Sources – CRR BPM

- Link to completed training
  - http://www.caiso.com/Documents/Presentation-CongestionRevenueRightsAuctionEfficiencyTrack1B.pdf
- Link to BPM for CRRs
  - https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Congestion Revenue Rights
    - Attachment J for Equations,
    - Section J.4. for Clawback
- Link to CMRI (filter for Post Market, CRR Revenue Adjustments
  - https://portal.caiso.com/cmri/logon.do